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Master Plan for Improving Water Quality in the Grand Calumet River/Indiana Harbor Canal

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Master Plan for Improving Water Quality in the Grand Calumet River/Indiana Harbor Canal

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16. ABSTRACT

The Grand Calumet River/Indiana Harbor Canal (GCR/IHC) drains a narrow, heavily industrialized watershed area of northwest Indiana, at the southern tip of Lake Michigan. Water quality and aquatic habitat problems in the GCR/IHC have been a matter of public concern for more than a decade. These problems are reflected in high concentrations of conventional, and toxic pollutants in the river sediments and overlying water column, and in sharply reduced levels of biological activity.

On November 15, 1983, the International Joint Commission convened a meeting to receive citizens' comments regarding the pollution control needs of the GCR/IHC. At this meeting, the U.S. EPA, Region V committed to the preparation of a plan, in consultation with the U.S. Army Corps of Engineers and the Indiana State Board of Health, for improving water quality in the GCR/IHC. This report has been prepared in fulfillment of this commitment.

The Master Plan report includes a discussion of existing environmental problems and pollutant sources, a presentation of existing water quality control programs, and recommendations for improving water quality and aquatic habitat conditions in the GCR/IHC.

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FINAL REPORT

MASTER PLAN FOR IMPROVING WATER QUALITY IN THE GRAND CALUMET RIVER/INDIANA HARBOR CANAL

January 1985

USEPA-REGION V
Water Division
230 South Dearborn Street (5WQ-TUB)
Chicago, Illinois 60604

PREFACE

The Grand Calumet River/Indiana Harbor Canal (GCR/IHC) drains a narrow, heavily industrialized watershed area of northwest Indiana, at the southern tip of Lake Michigan. Water quality and aquatic habitat problems in the GCR/IHC have been a matter of public concern for more than a decade. These problems are reflected in high concentrations of conventional, nonconventional and toxic pollutants in the river sediments and overlying water column, and in sharply reduced levels of biological activity.

On November 15, 1983, the International Joint Commission convened a public meeting to receive citizens' comments regarding the pollution control needs of the GCR/IHC. These comments were delivered through the Grand Calumet Task Force (a northwest Indiana citizens group). At this meeting, the U.S. EPA, Region V committed to the preparation of a plan, in consultation with the U.S. Army Corps of Engineers and the Indiana State Board of Health, for improving water quality in the GCR/IHC. This report has been prepared in fulfillment of this commitment.

The Master Plan report includes a discussion of existing environmental problems and pollutant sources (Chapter 2) and a presentation of existing water quality control programs (Chapter 3). A summary and conclusions section is presented in Chapter 4. The report concludes with recommendations for improving water quality and aquatic habitat conditions in the GCR/IHC (Chapter 5).

This report was originally released in draft form to provide an opportunity for agencies, industries, municipalities and other affected publics to comment on the content of the report and its recommendations. These comments and those made at a public meeting on Oct. 25, 1984 have been considered in preparation of the final report. Comments are still welcomed and may be addressed to:

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Chicago, Illinois 60604

Note:

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CHAPTER 1. INTRODUCTION AND BACKGROUND

1.1 PURPOSE AND NEED FOR PROJECT

This report represents the second step in a regulatory agency effort toward improving water quality and aquatic habitat conditions in the Grand Calumet River/Indiana Harbor Canal (GCR/IHC). The first step, which is already under way, involves aggressive implementation of existing pollution control programs. This report describes a set of regulatory and investigative initiatives to supplement the existing regulatory emphasis. These initiatives constitute the overall "master plan" for the GCR/IHC, and have been developed through an examination of existing water quality problems, an evaluation of the adequacy of existing control programs to address these problems, and development of control strategy alternatives. Subsequent work efforts will include joint agency implementation of selected control strategies and yearly progress monitoring.

The Master Plan effort includes and supplements U.S. Environmental Protection Agency (USEPA) and State of Indiana water quality control programs, already in place. These programs include best available technology (BAT) permit development, waste load allocations, pretreatment program development, and compliance actions (both municipal and industrial). The Master Plan process has been initiated to develop an implementation vehicle to coordinate these on-going efforts with new or additional directives. The Master Plan will be supplemented by longer-term investigations, to evaluate the effectiveness of existing and new control programs for enhancing water quality conditions in the GCR/IHC.

Water quality in the heavily urbanized Calumet Region of Northwest Indiana and Northeast Illinois has been a matter of local public concern for more than a decade. Continued poor water quality in streams draining this region to Southern Lake Michigan has also attracted Federal attention and involvement. In 1965, a public conference on pollution of the interstate waters of the Calumet Region was convened by the Secretary of Health, Education and Welfare, under the provisions of the Federal Water Pollution

Control Act. This conference was intended to initiate a coordinated planning, monitoring and evaluation program to assess the progress of continued pollution control efforts toward improving water quality in the Calumet Region. Baseline conditions were defined, from the existing data base, as a reference point from which to evaluate progress toward achieving water quality goals and objectives. Principle participants in this conference included representatives of the City of Chicago, the States of Illinois and Indiana, and the Federal Government.

Progress evaluation meetings were held, in 1967 and 1968, to assess the effectiveness of on-going pollution control programs and relative progress toward meeting water quality objectives. The conclusions drawn from these meetings were that no significant improvement in water quality had been realized over the 1965 baseline conditions, despite the general publicly owned treatment works (POTWs) and industrial discharge compliance with then-existing water quality criteria and requirements (Technical Committee on Water Quality 1970). In recognition of continuing water quality problems, the Calumet Area Water Quality Committee was appointed to review the adequacy of the existing water quality criteria, in light of new monitoring and surveillance data, and to formulate recommendations "... to achieve satisfactory water quality in the [Calumet] area." This committee included representatives from the Federal Water Pollution Control Administration, Metropolitan Sanitary District of Greater Chicago, Illinois Sanitary Water Board and the Indiana Stream Pollution Control Board.

The Committee concluded that existing and then-planned pollution control measures would be inadequate to meet water quality criteria and recommended implementation of additional pollution control programs. These recommended additional controls included:

- Long range programs toward recycling and re-use of municipal and industrial wastewater effluents
- Combined sewer overflow elimination by July 1, 1977
- Limitations on industrial discharges to municipal sewerage systems, allowing only those wastes for which "adequate... treatment facilities are available."

- Regulatory agency contingency plans to protect streams from industrial and municipal facility spills and equipment failures
- Development and application of "adequate and consistent effluent criteria" to protect area water quality until completion of industrial and municipal recycle facilities
- On-shore disposal of ship wastes, including provision of docking areas
- Establishment of a program of surveillance control points, to monitor compliance with existing and new (proposed) water quality standards
- Daily industrial waste analyses on composite samples from each outfall, and calculation of daily net waste loading rates
- Continuation of the Federal Water Quality Administration Surveillance Program to assess progress toward achieving water quality objectives.

Shortly after these recommendations were proposed, the Federal Water Pollution Control Administration was replaced by the United States Environmental Protection Agency (USEPA) and a nationwide initiative of pollution control programs was instituted. In the Calumet area, emphasis shifted away from implementation of the specific recommendations of the Calumet Area Water Quality Committee and toward implementation of the more generic, broader-scope USEPA water pollution control programs.

Many of the specific pollution control actions recommended by the Committee were included in the new USEPA program requirements, including: combined sewer overflow (CSO) control; industrial pretreatment; spill prevention, containment and control; waste load allocation; treatment of ship wastes; and effluent monitoring. While certain of these and other programs have been widely implemented, others are in development and will not be implemented for some time. Now that significant progress has been made in many areas, it is essential that future expenditures of pollution control funds be carefully integrated. The cause and effect nature of chronic water quality problems in the GCR/IHC is not fully understood, which limits the opportunities to selectively apply pollution control funds to specific water quality problems.

In recent years, citizens groups in Northwest Indiana have organized in voicing their concern for the continuing poor water quality in the GCR/IHC. Those concerns include unpleasant odors, health risks from proximity to (or unintentional contact with) the river, effects on Lake Michigan, aesthetics, and the generally degraded aquatic habitat, resulting from chronic water quality problems and physical modification of the stream channel. Public groups include organized citizens groups, area residents, labor unions, sportsmen and members of the scientific and academic community.

Several agencies have assisted in providing a forum for public input and in developing the technical and scientific basis for citizens concerns. For example, the State of Indiana entertained discussion of GCR/IHC problems during a recent public meeting and the International Joint Commission (IJC) coordinated a meeting of agencies and the concerned public. Also, the Lake Michigan Federation, in cooperation with local groups (in particular, the Grand Calumet Task Force), has organized a coordinated effort intended to focus public concerns and to draw regulatory agency attention to problems in the GCR/IHC.

The USEPA has recognized the limitations of the current regulatory approach for adequately addressing the complex water quality issues in the GCR/IHC. In November 1983, the Regional Administrator for USEPA Region V committed the Agency to the development of a Master Plan for improving water quality conditions in the GCR/IHC. This report is one step in the fulfillment of this commitment.

1.2 PROJECT GOALS AND OBJECTIVES

The Master Plan is, simply stated, an implementation framework for improving water quality in the GCR/IHC. This framework includes identification or development of required remedial actions, additional pollution control needs, responsible agencies, and an implementation schedule and plan. The Master Plan emphasizes the implementation of solutions to existing problems.

Specific goals and objectives of the Master Plan process represent the common interests of regulatory agencies and public interest groups, including the following:

- Enforce existing NPDES effluent limitations
- Apply existing regulations to achieve the pollutant load reductions required under current law
- Enhance water quality to support upgraded stream use designation and water quality standards
- Improve water quality to levels suitable for limited water contact recreation
- Improve aquatic habitat to support a balanced aquatic community of fish and other organisms
- Modify effluent permits to prevent the introduction of conventional (biological) contaminants in excess of the assimilative capacity of the receiving water
- Modify effluent permits to minimize the introduction of toxic pollutants
- Identify and control major non-point sources of toxic or other biologically-inhibiting pollutants
- Abate sediment contamination, which is a major potential contributor to continuing water quality degradation
- Identify the responsible, implementing agencies for recommended remedial programs and develop a realistic implementation timetable and progress monitoring schedule
- Abate and control pollutants contributing to water quality degradation in Lake Michigan.
- Generally eliminate health hazards, nuisance odors and degraded aesthetics (e.g., oil slicks) in the GCR/IHC.

These objectives will be realized through a coordinated series of Federal, State and local initiatives.

Although the Master Plan is cognizant of water quality issues throughout the Grand Calumet River system, the principle objective is to improve water quality and aquatic habitat conditions in that portion of the GCR system which drains through the IHC to Lake Michigan. Consequently, remedial alternatives focus on the East Branch, the Canal, and that portion of the West Branch of the GCR which normally drains east toward the IHC, taken broadly to include the Indiana portion of the West Branch. Also, due to the practical limits of the USEPA's jurisdictional control, the Agency is focusing attention on the immediate river channel; however, every reasonable effort will be made to coordinate water quality improvement programs with locally-sponsored streambank restoration and corridor enhancement efforts.

1.3 SUMMARY OF LOCAL ISSUES AND LIMITATIONS

In preparing the Master Plan, the USEPA has recognized the interactive nature of local socioeconomic conditions and potential remedial actions, and the possible impacts of these actions. Certain of the recommended remedial actions will result in additional pollution control costs for local municipalities and industries. Certain actions may also result in additional regulatory responsibilities for the Indiana State Board of Health (ISBH).

While the interests of area industries have not yet been officially represented in the Master Plan process, the USEPA has maintained sensitivity to possible conflicts between these interests and water quality goals and objectives. The action alternatives proposed in the Master Plan must be sensitive to the unique relationship which exists between industrial wastewater flows and the physical characteristics of the GCR/IHC.

It has been argued that the GCR/IHC is a "working river" and that its physical characteristics are so dependant on industrial discharges that the river should be exempted from the water quality expectations of other natural river systems. To some extent, this philosophy has been reflected in the ISBH use designation (partial body contact, limited aquatic life and industrial water supply) and water quality standards.

Specifically, the water use designation for the GCR/IHC, as established by the Indiana Stream Pollution Control Board (330 IAC 2-2-3), is based on a stated recognition that flows in the river are predominantly comprised of "... treated wastewaters and wastewaters of nonpoint source origin ... and that, historically, a major function of [the GCR/IHC] has been the conveyance of waters of such character" (State of Indiana, Stream Pollution Control Board 1978). Other factors cited in 330 IAC 2-2-3 in support of the use designation include the "... unnatural character of these stream beds" and the assumption that the river would not be capable of supporting a well-balanced fish community "... even if all wastewaters discharged to [the GCR/IHC] are provided the highest degree of treatment technologically and economically feasible."

Conversely, a growing number of local and area citzens and environmental conservation groups have questioned the Stream Pollution Control Board's water use designation for the GCR/IHC and have rejected the arguments on which this designation is based (see previous paragraph). While it is generally recognized that water quality in the GCR/IHC is a reflection of the historical, direct relationship between area industries and the river, and that this relationship has evolved over more than a century, the environmental interest groups do not accept these factors as justification for maintaining the status quo. These groups argue that despite its current and historical use patterns, the GCR/IHC is nevertheless a bona fide natural river and is therefore entitled to the regulatory protective benefits afforded other waterways of the state.

Support for a program to improve water quality in the GCR/IHC also comes from interest groups outside of the immediate watershed. These include conservation groups, who are concerned for the impacts of the GCR/IHC discharge on southern Lake Michigan; the City of Chicago, whose raw water intakes (in Lake Michigan) periodically intercept plumes of contaminated GCR/IHC waters; and environmental regulatory agencies (e.g.; other States and the International Joint Commission) charged with maintenance of water quality and aquatic habitat in the Great Lakes.

The State of Indiana has initiated a new wasteload allocation (WLA) modelling study for the GCR/IHC. When completed, the results of this study will be used in revising the existing discharge permits to the river. The current water quality standards (promulgated in 1978) were due for revision in 1981; however these revisions have been postponed pending completion of the WLA study. Regardless of the outcome of the current WLA process, the Indiana water quality standards must be revised, to reflect the current Section 304 (a)(1) USEPA water quality criteria. Through USEPA/State interaction, the GCR/IHC Master Plan process will influence the new water quality standards ultimately adopted for the river.

1.4 MAJOR ENVIRONMENTAL ISSUES

Environmental problems in the GCR/IHC have been recognized by regulatory agencies and citizens groups alike. Local residents have complained of unpleasant odors emanating from the river as well as degraded aesthetics, including oil slicks and an unnatural grayish color. The GCR/IHC has also been identified as a source of contaminants detected in the City of Chicago's Lake Michigan raw water intakes. Lake Michigan public beaches have been forced to close due to periodic bacteriological contamination of the Southern end of the Lake by the GCR/IHC discharge. The outfall of the GCR/IHC has resulted in a general impairment of water quality in lower Lake Michigan and may be inhibiting indigenous aquatic species. Within the GCR/IHC, concentrations of toxic substances as well as conventional and non-conventional contaminants are high, and few aquatic organisms exist.

Although recent improvements in water quality have been observed, the entire GCR/IHC aquatic environment has, historically, been severely degraded. During the 1970's, violations of all water quality standards occured more frequently in this river system than in any other Indiana stream (USEPA 1982). Water samples from the GCR/IHC have historically been high in unionized ammonia, cyanide, oil and grease, phenol, phosphorous, mercury, polychlorinated biphenols (PCBs), zinc, lead, selenium, iron, chloride, fluoride, and conductivity.

The sediments from the entire GCR/IHC system are characterized as "heavily polluted" (USEPA 1982), exhibiting some of the highest pollutant concentrations observed in the Great Lakes System (Lucas and Steinfield 1972). High concentrations of a wide variety of toxic substances have been identified by several investigators. Contaminants include PCBs, PAHs (polynuclear aromatic hydrocarbons), toxic metals (e.g., mercury, lead, zinc, arsenic, chromium, cadmium), and chlorinated organics. Conventional and nonconventional contaminants in high concentrations include phosphorus, nitrogen, oil and grease, biological oxygen demand (BOD) and chemical oxygen demand (COD). In acute toxicity tests conducted in 1972, those river sediments tested were found to be highly toxic to both vertebrate and invertebrate test species (USEPA 1983). However, tolerant invertebrate benthic species do inhabit selected areas of the river bottom, suggesting that significant local variation may exist in sediment quality.

The generally contaminated nature of the GCR/IHC sediments and overlying water column has been well documented. Pollutant loading rates from the major, known contaminant sources (e.g., industrial dischargers, POTWs and CSOs) have been calculated, and water quality models have been constructed to evaluate the impacts of variable pollutant loading rates on water quality in the river. However, the historical emphasis in these monitoring and modeling efforts has been on dissolved oxygen related and certain other pollutants, including BOD, COD, phosphorus, nitrogen, ammonia, cyanide and phenol. Water quality conditions in the GCR/IHC, as measured by these conventional indicators, have improved dramatically in recent years, owing to stricter effluent controls and a reduction in manufacturing. The frequency of water quality standards violations has decreased, while average dissolved oxygen (DO) concentrations have increased.

As conventional and nonconventional contaminants become more closely controlled, toxicants become increasingly important. Unfortunately, less is known about the sources, distribution and impacts of such contaminants in the GCR/IHC. In light of the demonstrated toxic properties of the sediments on aquatic organisms and the persistance of depressed biological activity in the GCR/IHC, it is becoming increasingly apparent that a major requirement in improving environmental conditions in the river is to develop an understanding of the toxicants issue.

Toxicants are known to be discharged from permitted point source outfalls to the river. Recent improvements in treatment technologies and effluent controls have resulted in reductions in point source toxicant loading rates, however a substantial reservoir of these materials is contained in river sediments. In addition to this *in situ* source, toxic pollutants are thought to be entering the GCR/IHC from other sources which are presently only poorly, if at all, understood. These sources may include constituents which are not specifically monitored in already-permitted point source discharges. Significant toxicant loadings may be derived from the the following point source categories:

- Combined sewer overflows
- Industrial contaminant "pass-through," from POTWs, and
- Direct industrial discharges.

These sources have become the focus of Federal and state pollution control efforts in recent years.

Because of the advances in point source controls, non-point sources may now be of equal or greater importance to restoration of the GCR/IHC. Significant non-point toxicant loading may be derived from the following possible sources:

- Leaching and dispersal from sediments
- Highway runoff, including spills
- Surface runoff from industrial properties contiguous to the river
- Seepage of contaminated groundwater from dumps, landfills, waste lagoons and underground storage tanks
- Rain scour and dust fall, and
- Illegal dumping.

Relatively little is known about non-point sources, in comparison with permitted sources. Original data collection and field studies may be required to competently evaluate the relative importance of these non-point sources.

1.5 AGENCY APPROACH

This report is structured to be consistent with the USEPA's approach for addressing the water quality problems in the GCR/IHC. This approach is based on the following four key precepts:

1. The efficacy of existing pollution control programs should be maximized before new programs are considered
2. Remedial programs must be based on a detailed, thorough understanding of the underlying problem causes
3. Remedial programs should be prioritized toward the most biologically-limiting pollutant sources, and
4. To be effective, remedial alternatives must be both implementable and enforceable.

Accordingly, this report has been organized to present key information and conclusions in the following format:

- An identification of existing pollution control needs
- A comparison of identified pollution control needs versus the scope of existing control programs
- An identification of additional data requirements
- Recommendations for new control programs and enhanced operation of existing programs.

The Master Plan process will continue, with interagency implementation of selected control programs and progress monitoring.

CHAPTER 2. EXISTING SITUATION

2.1 GRAND CALUMET RIVER BASIN

The Grand Calumet River Basin is located in the northwest corner of Indiana and the adjacent area of Illinois, as depicted in Figure 2-1. The basin encompasses approximately 43,242 acres and is almost wholly contained within Lake County (USEPA 1982). The Little Calumet River borders the basin to the south while Lake Michigan lies to the north.

The Grand Calumet River (GCR) originates at Marquette Park Lagoon, east of Gary. From the headwaters, the river flows approximately 13 miles to the west where it is joined by the West Branch and empties into the Indiana Harbor Canal (IHC), approximately three miles east of the Illinois State line. The IHC then flows north/northeast, for approximately five miles, and empties into southern Lake Michigan.

The topography of the basin is flat and flow tends to be sluggish. The bottom is covered with a mixture of organic debris, mud and sludge (USEPA 1982). Due to man-made alterations to the stream channel, the flow pattern of the GCR and the Indiana Harbor Canal (a man-made channel which connects the GCR to Lake Michigan) is complex. The East Branch of the GCR flows westward to the Indiana Harbor Canal (IHC) which flows northward to Lake Michigan. The West Branch of the GCR, however, is generally divided into two segments. One segment flows eastward into the IHC, while the other flows westward to Illinois. Normal flow patterns in the GCR/IHC are depicted in Figure 2-2.

The IHC normally flows to Lake Michigan because of the great rate at which lake water is pumped into the canal via the Grand Calumet River by the U.S. Steel Gary Works. This water is spent cooling water, containing comparatively low levels of contaminants, which has the effect of diluting other sources and maintaining a "flushing" influence on the river. Flow in the canal may reverse itself for short periods of time, however, depending on the stage of Lake Michigan. Flow reversals are known to extend into the West Branch of the GCR. Effluent from the Hammond municipal wastewater treatment plant discharges to that portion of the GCR which normally flows westward.

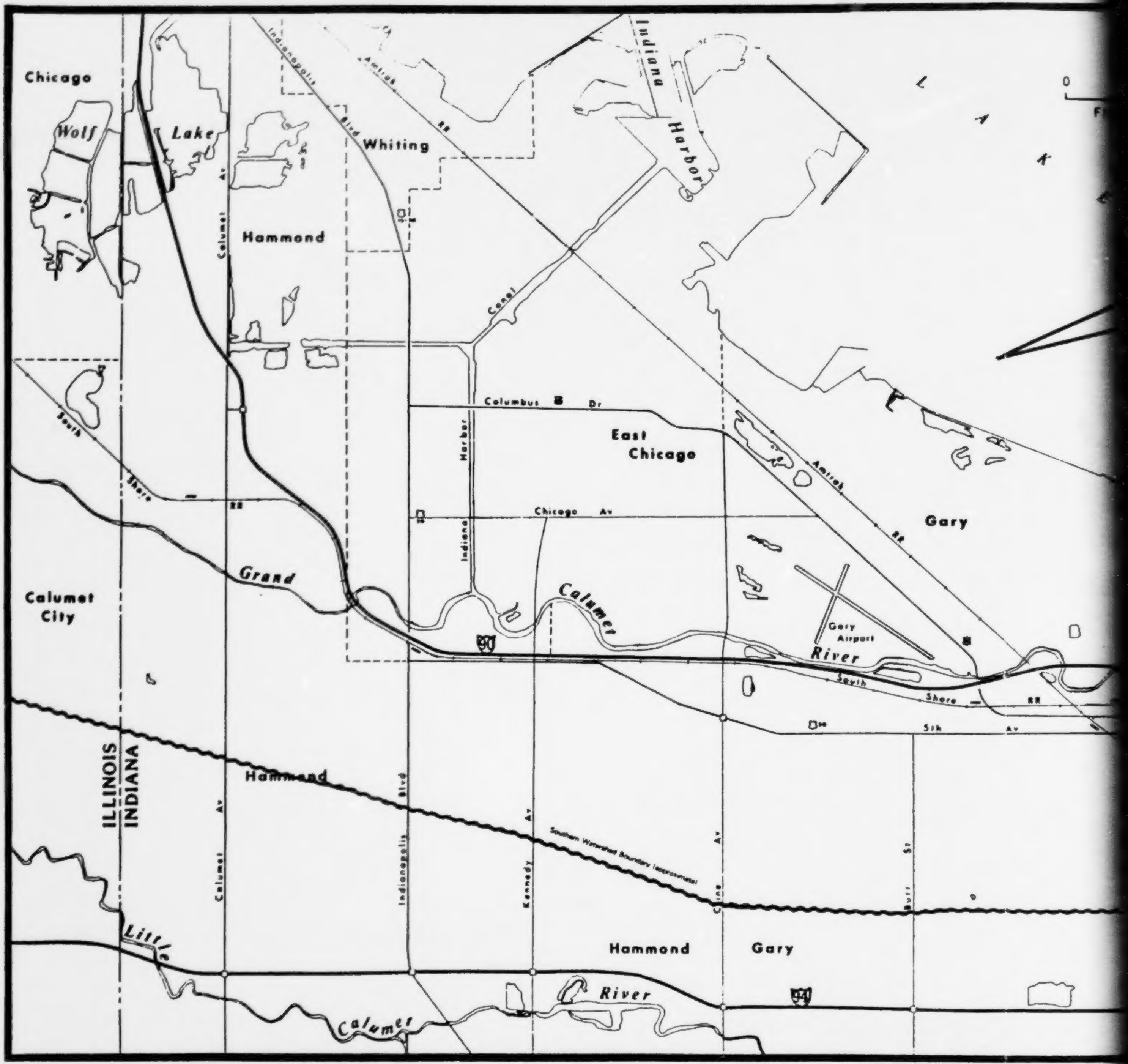
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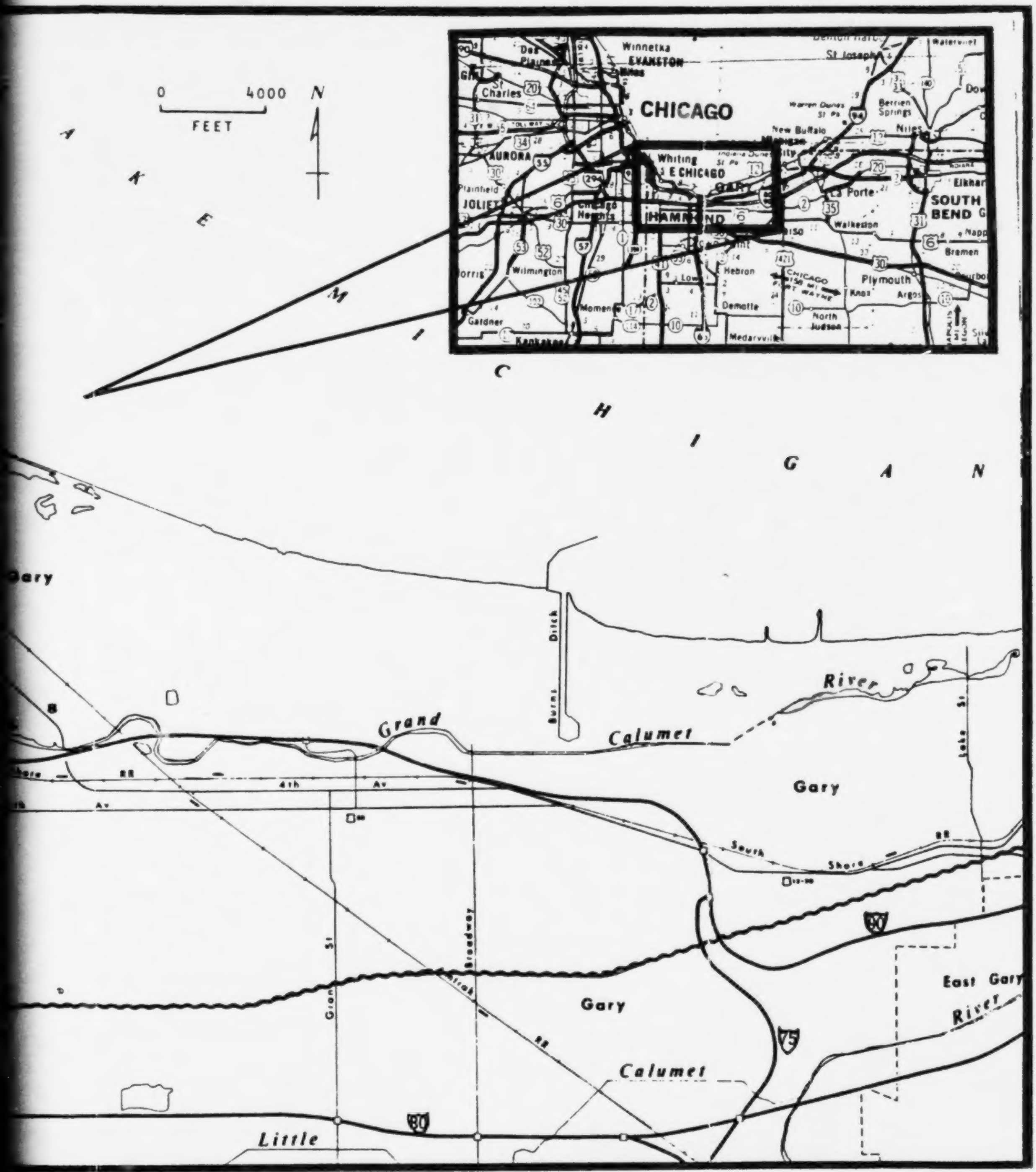
Figure 2-1. Grand Calumet River Basin and Surrounding Metropolitan Areas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GARY
Hebron
Demotte
Medaryville
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Knox
Plymouth
Walkerton
La Porte
New Buffalo
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Berrien Springs
Niles
Elkhart
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65
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East Gary
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tropolitan Areas of Northwest Indiana and Chicago, Illinois.

Source: Adapted from Lake Michigan Federation, 1984

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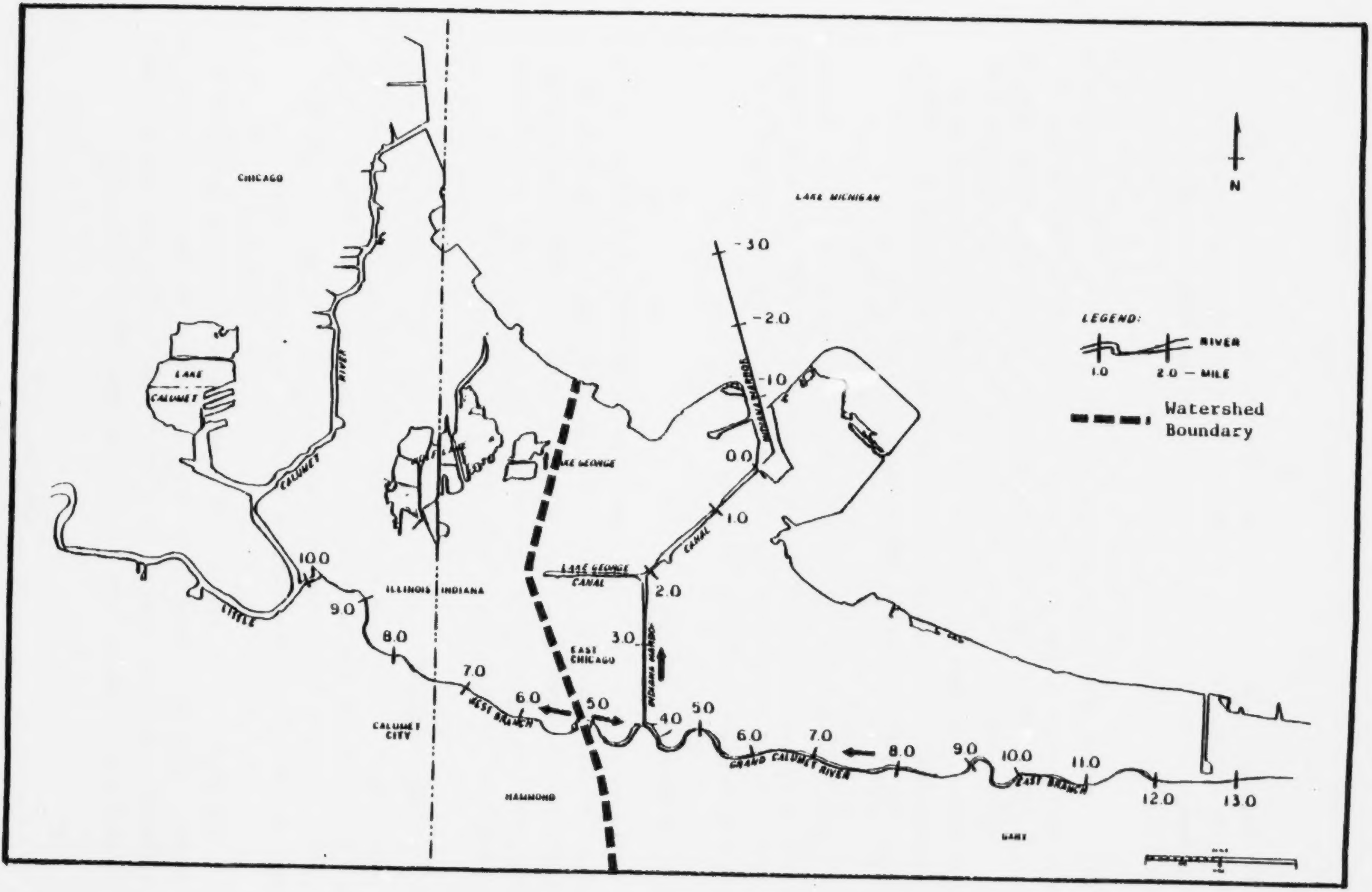
CHICAGO
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CALUMET CITY
HAMMOND
GARY
WEST BRANCH
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EAST BRANCH
-3.0
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RIVER
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Watershed Boundary

Figure 2-2
Stream Flow Direction in the GCR/IHC

Source: Adapted From Indiana State Board of Health (ISBH) 1984

The surface waters of the Grand Calumet basin are prone to flooding; drainage problems exist, due to regional topography and the character of land development in the area. The flooding and drainage problems contribute to the deterioration of water quality within the Basin.

No surface water gaging stations exist on the GCR/IHC. However, flow has been estimated to average 16 cfs in the West Branch and 880 cfs in the East Branch (USEPA 1982). Flow in the East Branch is sustained by high volumes of cooling water, derived from Lake Michigan, which is pumped to the River from U.S. Steel. More than 90 percent of the flow in the GCR/IHC originates as treated municipal and industrial wastewater, industrial cooling and process water, and stormwater runoff (USEPA 1982).

Although the entire GCR/IHC watershed is heavily urbanized, the principal urban centers are Gary, Hammond, East Chicago and Whiting. This area supports a population of over 500,000 and includes one of the most concentrated steel and petrochemicals industrial complexes in the U.S.

2.2 ENVIRONMENTAL PROBLEMS

This section of the report summarizes the observed environmental problems in the GCR/IHC as well as the known and suspected causes of these problems. A summary of the existing pollution control programs in effect on the GCR/IHC is also presented, including an assessment of the degree to which permitted dischargers are in compliance with existing discharge limits (Chapter 3).

2.2.1 Aquatic Habitat

The aquatic habitat in any river system includes both the water column and the substrate. The quality of the water in transit (ie; the water column) as well as the substrate (including sediments) are major determinants controlling the density, diversity and distribution of aquatic species.

The quality of the aquatic environment may be impaired by short-term phenomena, such as pollutant spills or slug loads, which are dissolved or suspended in the water column. These short-term phenomena may severely impact resident aquatic species, and may shift the populations of aquatic species toward those assemblages with short replacement times. However, if these pollutants are flushed from the stream with normal stream flow, the physical integrity of the environment is generally not disrupted. Under these circumstances, recolonization will readily occur, however, substantial time may be required before the natural species diversity and aquatic productivity return.

Long term, chronic sources of contaminants are far more damaging to the aquatic environment, because contaminants become attached to, and deposited in, the sediments. Under these circumstances, the substrate may become uninhabitable, eliminating a major component of the aquatic food chain. Contaminated sediments may then leach contaminants back into the overlying water column even after the source of the offending pollutant(s) has been abated.

Finally, the physical integrity of the aquatic habitat may be damaged through alteration of the stream channel. Common alterations include channelization and dredging activities as well as flow control structures, such as weirs and dams. These physical alterations may decrease the diversity of the stream habitat and correspondingly reduce the range (diversity) and density of aquatic organisms which the stream can support.

Environmental habitat conditions in the GCR/IHC are degraded. The sediments are grossly contaminated, resulting from long-term, chronic discharges of pollutants to the river. Pollutants contained within the sediments include persistent, non-biodegradeable as well as conventional contaminants. Although substantial reductions have been achieved for many pollutants, current pollutant loading for other contaminants continues at levels which exceed the natural assimilative capacity of the river; this situation is exacerbated by the depressed biological activity levels of the ecosystem.

The capability of the river to support fish and other aquatic life has been diminished by manmade alterations in the natural stream channel. Further, pollutants for which there is essentially no natural assimilative capacity have been, and continue to be, discharged to the river. As a result, the sediments contain varying amounts of persistent, toxic compounds which, in combination with those pollutants in the water column, create an inhospitable environment for fish and other aquatic organisms.

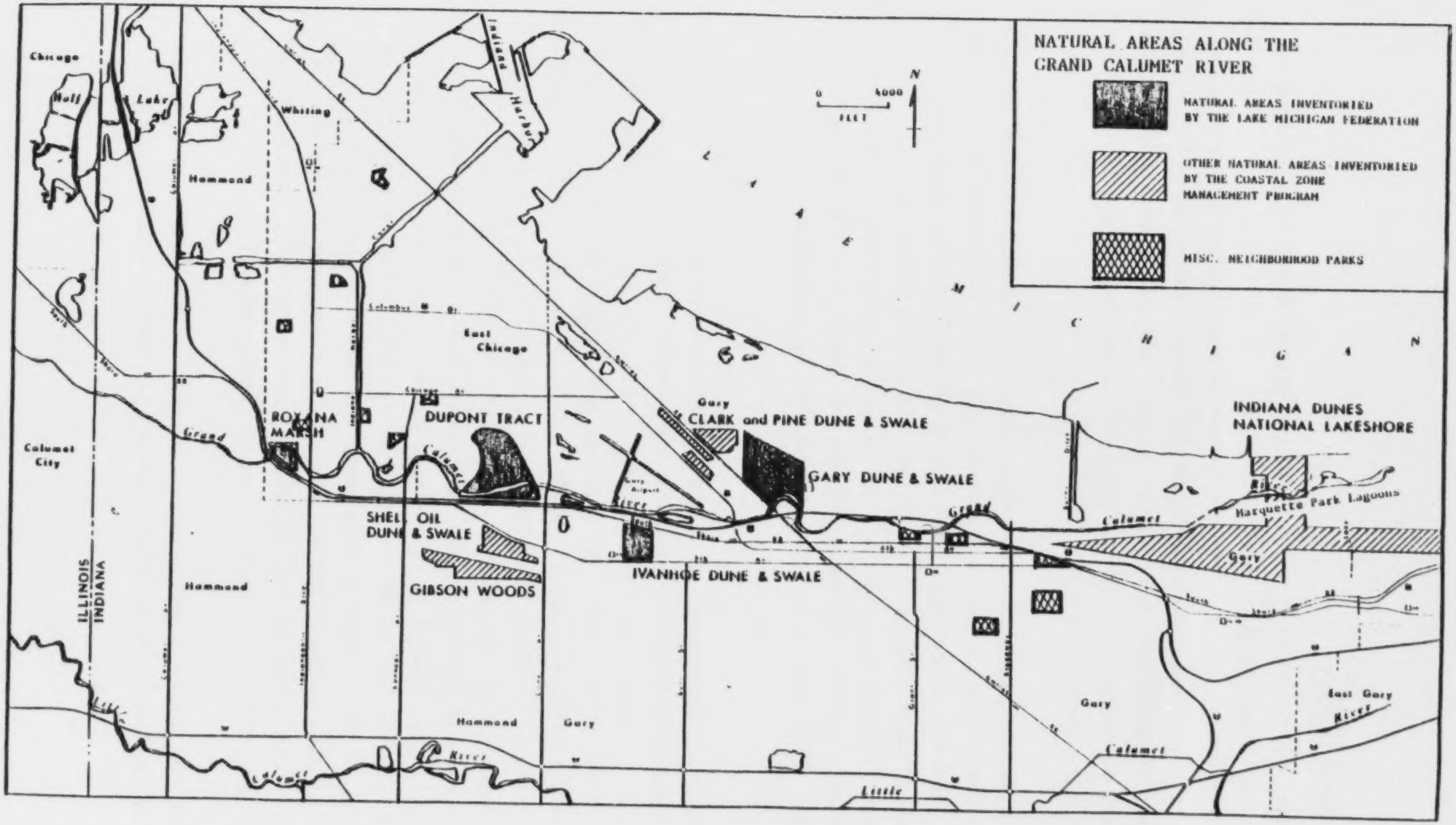
Although the GCR/IHC channel has been highly modified, significant natural wetland areas exist. These areas support a varied species assemblage of terrestrial and amphibious fauna. Water quality conditions in the GCR/IHC are considered to be major factors limiting the range of fish species observed in marsh areas. However, the extent of areas supporting natural emergent vegetation is apparently increasing, expanding the range and areal extent of habitat areas for aquatic species.

One natural area of particular note is Roxana Marsh, located near the Hammond POTW. A recent survey found the habitat of this freshwater wetland to include dense stands of cattails (*Typha latifolia*) which were rated as "...excellent cover for wildlife" (Lake Michigan Federation 1984). This survey also observed that cattails are spreading to shoreline areas adjacent to the marsh, through natural succession. The Marquette Park lagoons, at the headwaters of the GCR, represent other comparatively high-quality natural areas in the GCR/IHC system.

Roxanna Marsh and other natural areas along the GCR/IHC are depicted in Figure 2-3. With improvements in ambient water quality conditions in the GCR/IHC, natural areas, such as Roxana Marsh and others, are especially important as potential refuge and nursery areas for aquatic species.

A mechanism exists to evaluate the preservation merit of wetlands in particular areas, as an aid to future planning for dredge and fill activities. The USEPA is considering the merit of applying this system (the Advanced Identification of Disposal Sites) to evaluate the wetlands resources of the GCR/IHC basin. This consideration is coincidental with the Agency's review of the COE draft EIS on maintenance dredging of the IHC.

Aquatic habitat problems related to water quality, sediments and aquatic biota are summarized in the following discussions.


NATURAL AREAS ALONG THE GRAND CALUMET RIVER
NATURAL AREAS INVENTORIED BY THE LAKE MICHIGAN FEDERATION
OTHER NATURAL AREAS INVENTORIED BY THE COASTAL ZONE MANAGEMENT PROGRAM
MISC. NEIGHBORHOOD PARKS
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L A K E M I C H I G A N
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Wolf Lake
Whiting
Hammond
Indiana Harbor
Columbus Dr
East Chicago
Chicago Av
Calumet City
ILLINOIS
INDIANA
ROXANA MARSH
DUPONT TRACT
Grand
Calumet
River
SHELL OIL DUNE & SWALE
GIBSON WOODS
Gary Airport
Gary
CLARK and PINE DUNE & SWALE
GARY DUNE & SWALE
IVANHOE DUNE & SWALE
INDIANA DUNES NATIONAL LAKESHORE
Marquette Park Lagoons
Hammond
Gary
East Gary
Little
Calumet
River

Figure 2-3. Natural Areas Along The GCR/IHC

Source: Adapted from Lake Michigan Federation, 1984

2.2.2 Water Quality

Water quality conditions in the Grand Calumet River have improved dramatically over the past five to ten years. Much of this recent improvement in surface water quality can be attributed to construction of improved treatment plants, separation of stormwater sewers from sanitary facilities, and improved maintenance of POTW's. Industry has also played a major role in these gains, having committed large capital investments in improved wastewater treatment and water re-use facilities and practices.

Industrial compliance with permit limits and implementation of BPT and BAT treatment practices has reduced effluent loads to the GCR/IHC. To some extent, however, reductions in industrial effluent loading rates are a consequence of plant closings, relocation of discharge points outside of the watershed, and general production cut-backs resulting from the early 1980's recessionary period. Air borne contaminant loading over the watershed has also been significantly reduced, owing to recent reductions in industrial emissions.

Water quality monitoring of the GCR/IHC has been performed, by both private and governmental groups, in recent years. These efforts have been undertaken in support of areawide water quality management planning (TenEch 1977; Besozzi et al. 1976), CSO controls (PRC Consoer Townsend 1982; HNTB 1982; TenEch 1982) and, most recently, the WLA study (ISBH 1984). These investigations have provided evidence of a general trend of improving water quality conditions. For example, the minimum DO level reported in the ISBH monthly sampling records for the East Branch of the GCR at Station GCR37 (See Figure 2-4) was 1.8 mg/l in 1977, whereas the minimum value reported at this location in 1983 was 7.2 mg/l (ISBH 1984). From 1978 through 1984, no DO levels below the 5.0 mg/l standard were reported from this station (ISBH 1984), however, the sampling frequency may be inadequate to portray true minimum DO conditions at this location. Other examples of improved water quality conditions are provided in the following discussion.

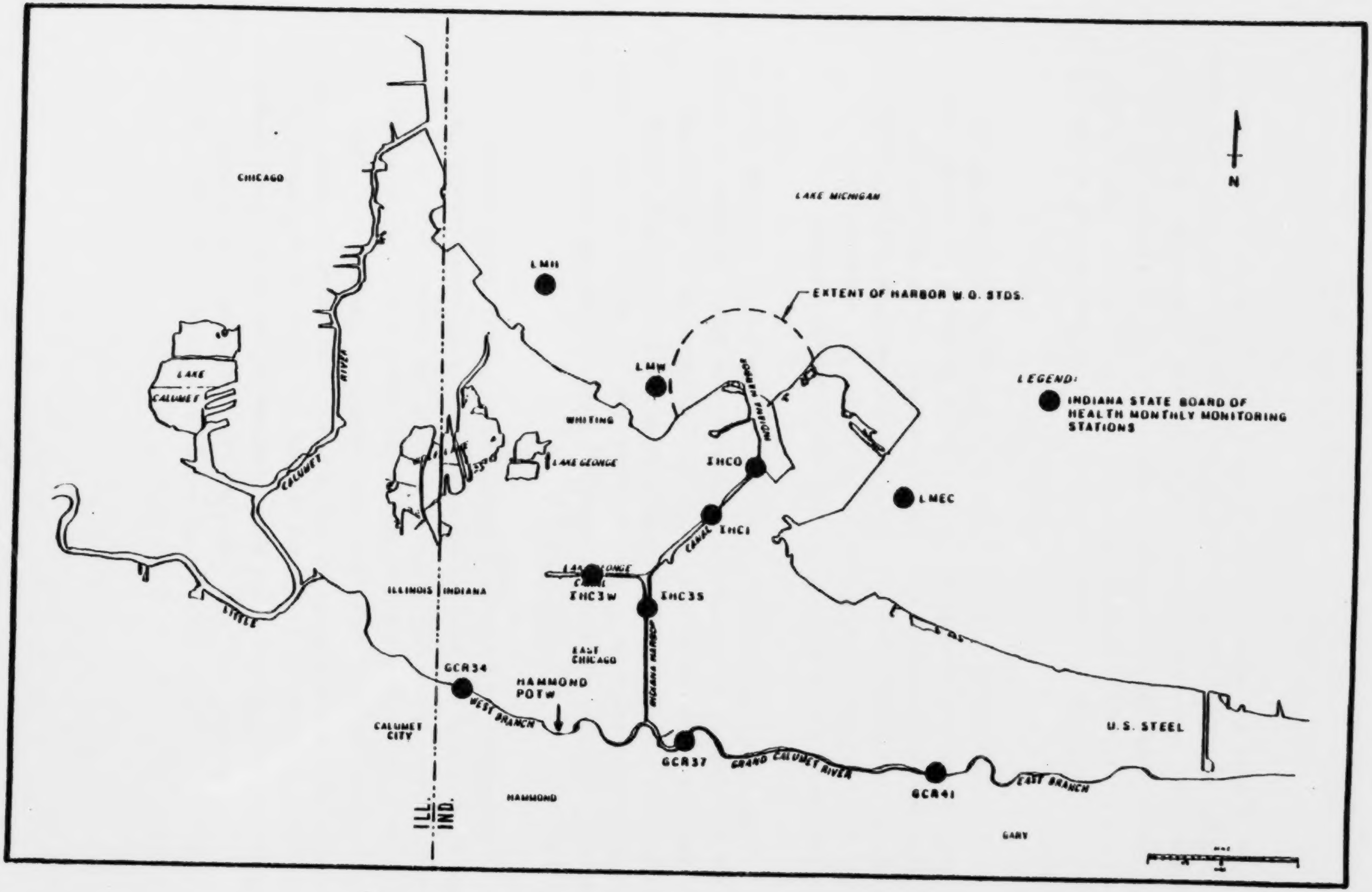
The ISBH conducts monthly water quality monitoring at a total of ten sites in the Grand Calumet River/Lake George Canal/Indiana Harbor Canal/

Indiana Harbor and nearshore Lake Michigan area. Locations of these sampling locations are shown in Figure 2-4. Within the Grand Calumet River and Indiana Harbor Canal, regular monitoring is performed for 15 parameters which are controlled under established water quality standards, including: pH, DO, fecal coliform, TDS, ammonia-N, cyanide, fluoride, dissolved iron, phenol, total mercury, PCBs, chlorides, sulfates, total phosphorus, and oil and grease.

Monthly water quality monitoring data compiled by the ISBH indicate chronic water quality problems for many of the monitored pollutants. Depending on sampling location, water quality standards for the GCR/IHC have historically reflected frequent violations for ammonia-N, cyanide, phenol, TDS, total phosphorus, chlorides, fluorides, mercury, sulfates, oil and grease, fecal coliforms, iron, and DO (USEPA 1982; ISBH 1984).

Significant improvements in water quality conditions in recent years have been reflected in the parameters monitored by the ISBH. In comparing 1977 to recent (1983) monitoring data for the GCR/IHC system, DO levels increased significantly while general decreases are evident for ammonia-N, cyanide, phenol, total phosphorous, fecal coliforms, and oil and grease. Total iron, mercury, chlorides and sulfates remained fairly constant during this period (ISBH 1984).

The general improvements in ambient water quality in the GCR/IHC are reflected in the decreased incidence of water quality standards violations in recent years. In the East Branch of the GCR, for example, eight of the fifteen parameters monitored monthly by the ISBH exceeded the applicable standards in 1977 (DO, fecal coliforms, ammonia-N, cyanide, total iron, phenol, total phosphorus and oil and grease). This number decreased to only 3 in 1983 (ammonia-N, total iron and chlorides). Similarly, the number of parameters in violation of the State standards in the IHC decreased from nine, in 1977 (DO, fecal coliforms, ammonia-N, cyanide, total iron, phenol, chlorides, total phosphorus and oil and grease), to only 2 in 1983 (ammonia-N and total iron).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LEGEND:
INDIANA STATE BOARD OF HEALTH MONTHLY MONITORING STATIONS
EXTENT OF HARBOR W.Q. STDS.
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IHC0
IHC1
CANAL
LAKE GEORGE CANAL
IHC3W
IHC3S
INDIANA HARBOR
ILLINOIS
INDIANA
EAST CHICAGO
GCR34
HAMMOND POTW
WEST BRANCH
CALUMET CITY
GCR37
GRAND CALUMET RIVER
GCR41
EAST BRANCH
U.S. STEEL
HAMMOND
GARY
ILL.
IND.

Figure 2-4
Locations of ISBH Monthly Water Quality Monitoring Stations

Source: ISBH 1984

Persistent water quality problems remain, however, in the GCR/IHC system. The West Branch of the GCR exhibits the worst of these problems. ISBH monthly monitoring data indicated ten of 15 monitored parameters in violation of the State water quality standards in 1977 (DO, fecal coliforms, ammonia-N, total iron, phenol, mercury, chlorides, sulfates, total phosphorus and oil and grease). This number decreased only to seven (fecal coliforms, ammonia, total iron, mercury, chlorides, sulfates and total phosphorus) in 1983 (ISBH 1984). Although the West Branch is the most polluted segment of the GCR/IHC system, this condition is more a reflection of flow conditions than differential pollutant loading rates. Average flow rate in the West Branch is only approximately 2 percent of the East Branch average flow.

In the GCR/IHC system in general, 1983 violations of the water quality standards were observed for ammonia-N; fecal coliforms, iron, mercury, phosphorus, chlorides and sulfates, based on ISBH monthly monitoring data (ISBH 1984). Although the ISBH has established a narrative toxicants water quality standard for the GCR/IHC, regular monitoring is not performed for toxic substances. Consequently, the nature and extent of priority pollutant contamination of the system is not fully known. However, various studies have shown substantial concentrations of toxic sustances (including PCBs, polynuclear aromatic hydrocarbons and a variety of toxic metals) in the GCR/IHC sediments. With the recent improvements in control of conventional contaminants, concentrations of toxic substances are felt to be the more important factor limiting biological productivity in the GCR/IHC. However, sufficient monitoring data do not exist to fully substantiate this hypothesis.

Since 1970, significant reductions in cyanide levels have been observed in the Grand Calumet River. Mean cyanide concentrations in the West Branch had often exceeded 0.8 mg/l in the early 1970's, but by 1981 were generally found to be below 0.05 mg/l. Throughout the basin, a 50 percent reduction in cyanide is estimated (CMSD 1983). Similarly, a 60 percent reduction in total ammonia nitrogen in surface waters was reported basin-wide. Also, mean suspended solids, iron, and fat-oil-and-grease content of the water were estimated to have fallen by 50 percent from 1970 to 1981 (CMSD 1983).

Between 1970 and 1981, dissolved oxygen levels in the Grand Calumet were estimated to have increased by 30 percent, on the average (CMSD 1983). In 1972-1973, DO levels in the most degraded section of the system (from river mile 0.5 to river mile 2.5) were below 3.0 mg/l during the critical months of July, August, and September (Combinatrics 1974). Dissolved oxygen throughout most of the river system is now reported to be sufficient to support warm water species of game fish, aquatic insects and forage species (ISBH 1984).

Between 1973 and 1977, phenol in the Grand Calumet River ranged between 0.025 and 0.085 mg/l in the East Branch and between 0.005 and 0.018 mg/l in the Ship Canal (CMSD 1983). Although no significant reductions in phenol were observed over the 1973 to 1977 period, the data base was reported to be insufficient to support conclusions regarding phenol trends. More recent data have been cited as evidence of currently decreasing phenol levels (ISBH 1984).

Substantial problems have always existed with oil sheens on the surface of much of the Grand Calumet, especially in the vicinity of now-closed refineries and the barge transfer facilities (between river miles 4.0 and Lake Michigan, including the Lake George Branch). Historically, fat-oil-and-grease (FOG) levels have been high throughout the GCR/IHC system. Significant reservoirs of FOG and petroleum based materials persist in the sediments. It may not be possible to eliminate the oil sheen problem until the historical deposits (ie., the sediments) as well as current sources, such as highway runoff and combined sewer overflows, are eliminated.

2.2.3 Sediments

Sediments often reflect the history of waste discharges to a waterway. Pollutants may sink to the bottom of their own accord, or may become attached to settleable materials. Once deposited, sediment contaminants may influence water quality long after the pollutant discharges have been abated, and may inhibit biological recolonization of the ecosystem.

Extensive sediment deposits exist in many areas of the GCR/IHC, with accumulated depths of up to 12 feet. Heaviest deposits are found in the West Branch of the GCR and in the IHC. The sediments have been shown to contain high concentrations of toxic substances, including PCBs, PAHs (polynuclear aromatic hydrocarbons), and various heavy metals, as well as conventional and non-conventional contaminants, such as oil and grease, phosphorous, nitrogen, iron, magnesium, manganese, volatile solids and COD (USEPA 1982).

Sediment contaminants are grouped into two broad categories: inorganic chemicals, such as metals (in elemental or insoluable salt form) and organic chemicals, such as solvents or insecticides. While substances from both groups may be mixed or bound together in the river sediment, it will be convenient to consider them separately.

Inorganics

A summary of metal concentrations measured in the GCR/IHC sediments is presented in Table 2-1. Similar data is presented for the Cal Sag Channel and Des Plaines River, for comparison. Although many of the metals reported in Table 2-1 may derive from local geology, the concentrations reported in the GCR/IHC are much greater than would be expected from natural, background sources. Although point sources are documented contributors, non-point sources (such as urban runoff) may also contribute materially to sediment metal levels. For example, tire wear on nearby roadways has been found to contribute to measurable increases in zinc levels in streams receiving highway runoff.

The Grand Calumet River sediment metals data reported in Table 2-1 are based on data collected as part of a 1980 sampling performed by the Great Lakes National Program Office (GLNPO) of the USEPA (USEPA 1982). Using the data reported by GLNPO, average metal levels were calculated for the Grand Calumet sediments (Table 2-1). The averages are based on seven core samples, taken between Bridge Street (located at the midpoint of the West Branch) and Columbus Drive (located south of the Indiana Harbor Canal "Y"), and on one additional core, taken in the East Branch at Indianapolis Boulevard. Each of the values included in the averages in Table 2-1 represents a composite of sediment characteristics across a sediment profile (by depth).

TABLE 2-1

Average Sediment Metal levels in the Grand Calumet River, the Des Plaines River, and the Cal-Sag Channel (USEPA 1982; COE 1981).

Metal	Concentrations, as milligrams per kilogram sediment (dry weight)[1] Grand Calumet (Average of 8 measurements)	Cal-Sag Channel (Average of 4 measurements)	Des Plaines (Average of 10 measurements)
Mercury (Hg)	0.73	0.42	5.4
Cadmium (Cd)	8	9	28
Arsenic (As)	27	19	21
Barium (Ba)	96	330	610
Nickel (Ni)	98	38	252
Copper (Cu)	182	120	340
Chromium (Cr)	408	110	200
Lead (Pb)	1,192	500	610
Manganese (Mn)	1,625	ND	ND
Zinc (Zn)	2,687	2,580	1,120
Iron (Fe)	128,710	ND	ND

ND=no data

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[1] Averages computed using less-than (<) data at numerical values.

The averages presented in Table 2-1 do not include data on sediment in the Indiana Harbor, the Lake George Branch, the Harbor Canal, or the turning basins. Sediments in these areas are being assessed by the U.S. Army Corps of Engineers (COE) in the Environmental Impact Statement now being prepared to evaluate proposed maintenance dredging of the Harbor (EIS publication expected in early 1985).

Table 2-1 includes comparable metals data for the Cal-Sag Channel and the Des Plaines River sediments. These data were derived from a report prepared by Argonne National Laboratories under sponsorship of the U.S. Army Corps of Engineers (COE 1981). The ten Cal-Sag Channel composite core samples from which the averages were derived are from a portion of the waterway which crosses a highly developed and industrialized area (the south side of Chicago), which is similar in character to the Grand Calumet River watershed. The four Des Plaines River composite core samples were taken between Joliet and Seneca, IL. The Des Plaines River carries runoff and effluent discharges from the Chicago and Joliet, IL transportation corridors and industries.

USEPA Region V has established guidelines for assessing the pollution characteristics of Great Lakes harbor sediments. The guidelines were developed as an aid in assessing the suitability for open lake disposal of dredged harbor sediments. These guidelines are presented in Table 2-2, expressed in mg/kg. Comparing the average metals concentrations of Grand Calumet River sediments with the Table 2-2 guidelines, the sediments are considered heavily polluted for all Table 2-1 metals, except mercury.

Sediment metals reflect long term changes or trends in pollution runoff from surrounding land areas and from effluent discharges. However, sedimentary metals may be locally diluted by deposition of silt or clay from upland erosion. Further, historically high rates of metal discharges may bias any comparison if the water bodies being compared were not dredged to the same extent after modern pollution control measures were implemented. Finally, sediment metals may be released to the overlying water column under certain environmental conditions, such as low pH, low DO and reducing conditions. The rate of metals resolubilization varies with the individual metal, local

TABLE 2-2

USEPA Region V Guidelines for the Pollution Classification of Great Lakes Harbor Sediments

Compound (mg/kg dry weight)	Non-polluted (mg/kg)	Polluted (mg/kg)	Moderately polluted (mg/kg)	Heavily polluted (mg/kg)
Mercury		≥1		
Cadmium	*		*	>6
Arsenic	<3		3-8	>8
Barium	<20		20-60	>60
Nickel	<20		20-50	>50
Copper	<25		25-50	>50
Chromium	<25		25-75	>75
Lead	<40		40-60	>60
Manganese	<300		300-500	>500
Zinc	<90		90-200	>200
Iron	<17,000		17,000-25,000	>25,000
Cyanide	<0.10		0.10-0.25	>0.25
Ammonia	<75		75-200	>200
Total PCBs		≥10		

*Lower limits not established.

Source: USEPA 1982

environmental conditions and the nature of any complexing with other compounds.

Because of these possible sources of bias between data sets (see above), the averages in Table 2-1 cannot be relied on to quantify the relative severity of metal contamination in the sediments of the Grand Calumet, as compared to the other two rivers. However, qualitative comparisons can be made to gain insight into sediment metal contamination problems unique to the Grand Calumet River.

Based on the averages presented in Table 2-1, seven of the eleven metals are at similar concentrations in the sediments of all three rivers. Iron, manganese, chromium and lead appear to have been very abundant in the Grand Calumet sediments during 1980. Steel making is likely to have been a major cultural source of the iron, manganese and chromium. In spite of the continuous and significant progress made in pollution abatement over the last decade, the impact of steel production on sediments of the Grand Calumet appears to have remained significant. Elemental iron, calculated as the average of the sediment core profiles (Table 2-1), constitutes almost 13 percent by weight of the total average dry weight of the samples.

A lead refinery has been in operation near the East Branch of the River for many years. The U.S.S. Lead Refinery, a secondary smelting facility located at 5300 N. Kennedy Avenue in East Chicago, recyles scrap lead sources such as batteries. This facility, which includes scrap stockpiles and a fill area for process wastes, is situated on the north bank of the East Branch, approximately 3/4 of a mile upstream of the confluence of the East and West Branches. This facility is a suspected source contributing to the observed high lead levels in the river sediments.

Because of periodic water level changes in Lake Michigan, the Grand Calumet may reverse its flow direction as often as two to four times per day. This effect extends as far upstream as the Kennedy Avenue bridge, on the East Branch, and the Highway 90 Tollway bridge, on the West Branch (ISBH 1984; Combinatorics 1974). Therefore, lead associated with particulate emissions and soil eroded from the vicinity of the U.S.S. Lead Refinery could have become distributed over large areas of sediments of both branches as well as the mainstream of the Grand Calumet.

A more recent sediment sampling program in the Grand Calumet analyzed the metals content of surficial sediment layers only. This sampling was conducted for the Indiana State Board of Health (ISBH 1984). A total of ten sediment grab samples were taken during January, 1984, at locations scattered throughout the GCR/IHC. Data from this recent sediment sampling program can be considered to be less reflective of historic pollutant deposition than the core-composite data from the 1980 sampling (Table 2-1). However, comparison of the recent grab sample data with the core-composite sample averages may indicate whether any significant metal sources have recently been abated.

Table 2-3 presents selected metals content data from the 1984 sampling effort, in direct comparison with the average 1980 data for the Grand Calumet, as calculated for Table 2-1. Results from eight of the 1984 sampling stations were averaged to create Table 2-3. Although 10 stations were sampled in the 1984 survey, data from the two stations located below milepoint 2.6 in the Indiana Harbor Canal were excluded from the average, to allow direct comparison with the 1980 data.

Based on comparison of the averages presented in Table 2-3, the only substantial reduction in sediment metal levels that may have occurred in recent years is with lead and zinc. The 1984 average lead concentration is approximately 35 percent of the 1980 average, and the 1984 average zinc concentration is approximately 36 percent of the 1980 average. The apparent downward trend in these two metals may indicate that transportation related sources of lead and zinc may have abated. A trend of decreasing lead and zinc in runoff has been reported in other U.S. locations and has been attributed to the gradually imposed ban on leaded gasoline and to reduced traffic volumes. Alternatively, an industrial or commercial source of zinc and lead may have been significantly reduced between the 1980 and 1984 sampling events.

TABLE 2-3

Comparison of Averaged 1982 and 1984 Metals Content of GCR Sediments[1].

Source	ISBH 1984	USEPA 1982
Sampling date	January 1984	October 1980
Metal	Reported Concentrations (ug/g dry wt.)	
Mercury (Hg)	0.68	0.73
Cadmium (Cd)	7	8
Arsenic (As)	18	27
Nickel (Ni)	140	98
Copper (Cu)	214	182
Chromium (Cr)	561	408
Lead (Pb)	414	1192
Zinc (Zn)	955	2687

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[1] Data are presented only for metals which coincidentally were sampled in both the referenced studies.

Data from the 1980 and 1984 sampling programs is inadequate to determine if lead transport from the U.S.S. Lead Refinery has recently abated, resulting in the observed reduction in average lead levels. Sediment data from the two studies used to develop Tables 2-1 and 2-3 were collected at the Kennedy Avenue bridge, which is upstream of the Refinery and its associated solid waste disposal site. Other samples were collected in the West Branch, at Indianapolis Boulevard (1.1 mile west), and at the 151st Street bridge (0.9 mile downstream), on the mainstem. These two stations are influenced by combined sewer overflows which may include lead and zinc from industrial effluent sources.

Significant variation in concentrations of sampled metals exists between locations in the 1980 and 1984 sampling events. However, variations in sampling location, technique and analytical protocol may be significant contributors to these variations. Additional sources of sample bias may include local contribution of recent, "clean" sediments, or sediment scour.

Differences in sampling design and technique between the 1980 and 1984 sampling events limits further direct comparisons and conclusions. While conditions appear to have improved for some contaminants, the reverse appears to be indicated for others. The WLA for the GCR/IHC (ISBH 1984) suggests some improvement in sediment quality, however, a reliable analysis of the representative sediment contaminant levels, and identification of priority zones for remedial actions, can only be achieved following a carefully designed and executed sampling program.

Organics

Organic contaminants in Grand Calumet River sediments may derive from a large number of historic and modern sources. Among the more dominant industrial sources are steel mill coking ovens, petrochemical producers and shippers, and refineries. Municipal wastewater treatment plant discharges and combined sewer overflows also are major sources of organic chemicals, particularly oils, fats, and greases. Oils and grease also are prevalent in transportation corridor and parking lot runoff to the river. Air emissions of hydrocarbons may be rain scavenged and deposited in the watershed.

Metal fabrication industries, which once used PCBs extensively in hydraulic production machinery, are a potential source of PCB contamination. PCB arochlor 1248 was the predominant isomer in the 1984 sampling results (ISBH 1984). No readily discernible patterns are recognized through comparison of 1984 PCB (1248 isomer) levels with 1980 total PCB levels.

Highest PCB sediment concentrations are reported from the IHC, with up to 89.2 mg/kg recorded in one core sample (USEPA 1982). Although high variability exists in the sediment cores PCB data, the highest concentrations are believed to exist in the deeper portions of the IHC sediments and in the more surficial layers of the GCR sediments (USEPA 1982).

Additional parameters which may indicate the relative degree of organic pollution include phenol and total organic carbon (TOC). While the West Branch also has relatively high concentrations of phenol in surficial sediments, the highest phenol concentrations were found in the East Branch. TOC data are insufficient to support comparisons of relative pollution characteristics.

High concentrations of polynuclear aromatic hydrocarbons (PAHs) have been identified in various sampling locations in the GRC/IHC. PAH concentrations as high as 1800 ppm have been identified, including benz(a)pyrene, phenanthrene and anthracene. Benz(a)pyrene, a carcinogenic PAH, was observed in concentrations as high as 50 ppm in the IHC. In the GCR, phenanthrene and anthracene concentrations of as much as 5300 ppm have been reported (near U.S. Steel), while benz(a)pyrene was reported at 380-ppm at this location (USEPA, 1982).

Analysis of the history of sediment contamination is complicated by sediment scour and re-deposition throughout the GCR/IHC system. As a result, some areas are nearly devoid of sediments while deep deposits exist in other areas. Contaminants have become mixed, and deposited in areas of accumulated sediments. Principle areas of sediment scour occur from approximately river mile 7.5 in the East Branch to the East Branch/West Branch confluence. An area of sediment deposition occurs in the vicinity of this confluence. The more southerly portion of the IHC is also scoured, while the portion nearer the Lake (the dredged portion of the IHC) is marked by sediment deposits. The highest concentrations of sediment contaminants are observed in the zones of sediment accumulation (USEPA 1982).

2.2.4 Sediment Toxicity Factors

The sediments of the GCR/IHC have been found to be contaminated with both inorganic and synthetic organic pollutants (see preceding discussion). Although integrated biological/chemical surveys have not been conducted, the monitoring data that are available clearly indicate widespread contamination of sediments. No formal evaluation has been made, however, of the risks to aquatic life or human health from exposure to waters or sediments of the GCR/IHC. Although insufficient data and other site specific information is available to develop a full risk assessment, a preliminary comparison of known contaminants and potential health risks is presented in this section.

In general, risk assessment consists of several independent but related assessments, the results of which are used in understanding and anticipating adverse health effects, and in predicting their incidence of occurence. Risk assessment may be divided into three major components: (1) hazard assessment, consisting of hazard identification and dose-response (toxicological) assessment; (2) exposure assessment, including the process of identifying exposure pathways, measuring or estimating the levels of exposure to contaminants, and the identification of the species, populations, or systems at risk; and (3) risk characterization, consisting of the comparison of doses (or levels of exposure if dose cannot be estimated) received by exposed populations, with acceptable toxicological endpoints for subchronic and chronic exposure.

The most meaningful evaluation of sediment contamination of the GCR/IHC would consist of an assessment (as outlined above) of risks to aquatic life and human health. The data requirements necessary to conduct such an evaluation (excluding risks to human health through consumption of contaminated organisms or drinking water) are as follows:

- Monitoring data on levels of contaminants in sediments, biota, the water column, and discharges (point and non-point sources) to the GCR/IHC
- Toxicological information on identified contaminants: levels associated with subchronic and chronic effects, and carcinogenic risks
- Physical/chemical, water and sediment quality data on the GCR/IHC systems (e.g., TOC, sediment type, DO, etc.)
- Physical/chemical and biological data on the transport and transformation of selected contaminants in the environment. Of particular importance to this effort is information on the movement of contaminants between sediment and water, and sediment and biota
- Identification of species and populations at risk of exposure
- Estimates of dose/levels of exposure for each contaminant under investigation, for each exposure route, and each species/population at risk of exposure.

The data currently available is generally limited to sampling results which describe only the concentration or absence of pollutants in GCR/IHC sediments. This data is clearly insufficient to fully evaluate the magnitude and severity of the contamination problem. This may be accomplished only through a knowledge of mobility of the selected compounds, the levels of exposure to species/populations at risk, and the effective toxicity of the pollutants in the aquatic system under existing environmental conditions (e.g., hardness, pH, DO). Because of the highly limited nature of the available data, the level of evaluation must be modified accordingly to include only a very limited and qualitative assessment of the sediment contamination problem.

2.2.4.1 Data Sources

A limited number of studies are available on the Grand Calumet River sediments on which to base an analysis. The major historical studies were conducted by the, USEPA Office of Enforcement and General Counsel -- Cincinnati (in 1973), Chicago District Corps of Engineers (in 1979), and Hydroqual (in 1983). A USEPA study conducted in 1977 sampled only Indiana Harbor Canal sediments.

In the 1973 study, the USEPA collected sediment samples from the Grand Calumet River system, from Lake Street through the undredged portion of the canal. Sediment cores were taken at each of the eight sampling stations. The cores were divided into strata and a chemical analysis performed on each stratum. Samples were analyzed for phenols, cyanide, solids, and a variety of metals. No analyses for organic compounds were conducted.

The Chicago District Corps of Engineers conducted sediment sampling of the Indiana Harbor and the Indiana Harbor Canal in 1979 in relation to proposed maintenance dredging. Samples were collected from various depths and composited to make one sample for each three foot depth increment. A total of 34 composite samples were prepared. Samples were analyzed for PCBs, solids, nitrogen, phosphorus, oil and grease, and a variety of metals. No analyses for organic compounds were conducted.

The most recent and most extensive sampling and analysis of Grand Calumet River sediments was conducted by Hydroqual in 1983 as part of a wasteload allocation modeling effort prepared for the ISBH. Sediment samples were collected at 10 locations to include the East Branch, West Branch, and Indiana Harbor Canal. Surface sediment samples were collected with a ponar dredge. Sediment samples were analyzed for all priority pollutants except the volatile organic pollutants.

The analysis and interpretation of the sediment contaminants that follows concentrates on the results of the Hydroqual study. All calculations, except where noted, are based on the maximum concentrations of contaminants that were measured by this study. The Hydroqual study contains the most recent and comprehensive sampling data on the sediments. Although only surface sediments were sampled, and may not reflect historical contamination, they appear representative of the greatest sediment concentrations (USEPA 1982).

2.2.4.2 Approach to Analysis

Only limited information is available with which to evaluate the risks to aquatic life and human health of the sediment contamination of the GCR/IHC. As discussed previously, the minimum data requirements for this type of assessment are information on species and populations at risk of exposure, an estimate of levels of exposure, and a knowledge of the toxicity of the selected contaminants under investigation. In the absence of this information, and given the available data, this assessment focuses only on identifying and ranking sediment contaminants of concern. The ranking provides a preliminary evaluation of the magnitude of sediment contamination in the GCR/IHC, and focuses attention on compounds most likely to pose the greatest potential risk to aquatic life and human health.

In order to rank the sediment contaminants, a simple index has been developed which incorporates both maximum observed concentration of a contaminant and toxicity of the compound to aquatic life or human health. The index is of the following form:

$$\text{Score}_x = \frac{C_s^x}{(CR)\ (K_{oc})\ (TOC)}$$

where:

C_s^x = concentration of contaminant x in the sediment;

CR = the ambient water quality criterion for contaminant x;

K_{oc} = the sediment/water partition coefficient for contaminant x adjusted for organic carbon content of sediment; and

TOC = the total organic carbon content of the sediment (expressed as a percentage).

The right side of the preceding equation is equivalent to the ratio of the predicted concentration of contaminant x in the sediment interstitial water divided by the ambient water quality criteria:

$$K_D = \frac{C_s^x}{C_w^x}$$

$$K_{oc} = K_D \times \frac{1}{TOC} = \frac{C_s^x}{(C_w^x)\ (TOC)}$$

$$C_w^x = \frac{C_s^x}{(K_{oc})\ (TOC)}$$

$$\frac{C_w^x}{CR} = \frac{C_s^x}{(CR)\ (K_{oc})\ (TOC)}$$

where:

K_D = the sediment-water partition coefficient unadjusted for dependence on organic carbon; and

C_w^x = the concentration of contaminant x in the water phase.

Emphasis has been placed on evaluating priority pollutants [CWA Section 307(a)(1)] because of the availability of ambient water quality criteria or general toxicological information for these chemicals (USEPA 1980, 1984). Separate rankings, based on index scores, have been developed for aquatic life and human health. The summary for human health has further been divided into separate rankings for non-carcinogens and carcinogens.

Levels of contaminants in the sediment would most readily be evaluated using sediment criteria as a basis for comparison. Although methods for derivation of sediment criteria are under consideration by the USEPA, these criteria are not yet available. Therefore, ambient water quality criteria have been used in discussing the magnitude of the sediment contamination problem in the GCR/IHC. Appropriate use of ambient criteria requires comparison with pollutant levels in the water column. For the purposes of this analysis, the ambient water column concentrations which would result from the known levels of these compounds in the sediment must be estimated. The sediment-water partition coefficient (K_{oc}) has been used in the equation in conjunction with the maximum sediment concentrations to derive this estimate.

The K_{oc} value indicates the extent to which a compound partitions between the solid and solution phases of water-saturated sediment. It expresses the ratio of the amount of the chemical adsorbed per unit weight of organic carbon in the sediment to the concentration of the chemical in solution at equilibrium.

The K_{oc} values may be used to calculate the concentration of a contaminant in the interstitial or pore water of the sediments, as a function of the measured concentration of material absorbed to the sediment substrate itself. Given the sediments as the sole source of contaminants under investigation, the concentrations of these contaminants in the overlying water column would be a function of the rate of diffusive exchange of the interstitial water with the overlying water column. Concentrations in the water column are therefore affected by the total volume and flow rate of the overlying water. It is important to note that the calculated ambient water concentrations presented in this discussion refer to the concentrations of contaminants in the interstitial water at the sediment/water interface. In the absence of other sources of contamination, water column concentrations may be considerably less than the concentration in the interstitial water.

Certain limitations exist to the use of the sediment/water partition coefficient. For example, many contaminants of environmental concern are base-neutral organic compounds. These chemicals are relatively insensitive to changes in reduction/oxidation (redox) potential, pH, and dissolved oxygen in the surrounding environmental media. Therefore, K_{oc} values for these contaminants may be more confidently used in predicting mobility in the aquatic system than for ionizing organic compounds or trace metal contaminants. Mobility of these latter two classes of pollutants is much more a function of the prevailing environmental conditions than for neutral compounds. Under reducing conditions, low pH and low levels of dissolved oxygen, for example, resolubilization of heavy metals may occur, releasing these elements to the water column.

It should also be noted that the K_{oc} values used in this report were derived independently of the sediment type and organic carbon content of the GCR/IHC system. In the absence of available data on the GCR/IHC system, a 5 percent organic carbon content has been assumed in this analysis. The K_{oc} values for trace metals used in this report have been derived empirically (see JRB Associates 1984) from measurements of trace metal concentrations in interstitial water and bulk sediments from a variety of substrate types. Empirical K_{oc} values were calculated for each substrate type (as an arithmetic mean, with an assigned standard derivation).

The variability of the K_{oc} values for metals reflects the complexity of the partioning process between the interstitial water and sediments. Partitioning is a function of chemical speciation, the oxidation-reduction potential at the solid-aqueous interface, the type of clay minerals present, the nature of the organic matter on both sedimentary particles and interstitial water, pH, and particle size. Neither these variables nor the physical/chemical processes responsible for mediating the transport of trace metals from sediments to the aqueous phase are well understood. These relationships are not sufficiently quantified to support a theoretical computation of sediment-water partition coefficient as has been conducted for the organic compounds.

Although this discussion concentrates on the water quality impacts resulting from resolubilization of sediment contaminants, additional impacts may occur as a result of resuspension. Eroded sediments, suspended in the water column, may impair water quality and aquatic biota in transit. Additional impacts may then occur in downstream areas where these suspended sediments settle out of the water column and redeposit.

2.2.4.3 Results of Analysis

As discussed previously, the predicted concentrations of toxic substances are based on the rates at which contaminants in the sediments are exchanged with interstitial water in the sediments and are predicated upon certain assumptions. This analysis cannot predict the concentrations of toxics in the water column overlying the sediments, as the rate of exchange between interstitial and overlying water is not known. Therefore, the effects of dilution on calculated toxic concentrations cannot be included in this analysis. Therefore, the predicted concentrations presented here are an approximation of the anticipated concentrations at the sediment surface.

Results of the evaluation of the types and concentrations of contaminants in the GCR/IHC sediments are presented in Tables 2-4 through 2-6. Table 2-4 is a listing of (1) maximum contaminant levels in sediments as measured by Hydroqual in 1983, (2) sediment-water partition coefficients (K_{oc}), (3) calculated interstitial water concentrations, and (4) ambient water quality

TABLE 2-4

CONCENTRATIONS OF PRIORITY POLLUTANTS IN SEDIMENTS OF THE GRAND CALUMET RIVER SYSTEM, THE CORRESPONDING K_{oc} VALUES, AND THE USEPA WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE AND HUMAN HEALTH

Pollutant	Sediment concentration(1) (ug/g)	K_{oc}	Interstitial water concentration (mg/l)	Aquatic life criteria		Human health criteria(3) (mg/l)
				acute(2) (mg/l)	chronic (mg/l)	
Polychlorinated biphenyls						
Arochlor 1248	17	2.8×10^5	1.2×10^{-3}	0.002	1.4×10^{-5}	7.9×10^{-8}
Arochlor 1254	6.9	5.3×10^5	2.6×10^{-4}	0.002	1.4×10^{-5}	7.9×10^{-8}
Monocyclic aromatic chemicals						
1,2-Dichlorobenzene	0.04	1.7×10^3	5.2×10^{-3}	<1.12	<0.763	0.4
1,4-Dichlorobenzene	0.14	1.7×10^3	1.6×10^{-3}	<1.12	0.763	0.4
Phthalate esters						
Di-N-octyl phthalate	47	3.6×10^9	2.6×10^{-7}	<0.94	<0.003	--
Bis(2-ethylhexyl)phthalate	26.0	1.7×10^5	3.9×10^{-3}	<0.94	<0.003	--
Butyl benzyl phthalate	0.6	1.7×10^5	7.0×10^{-5}	<0.94	<0.003	--
Di-N-butyl phthalate	0.8	1.7×10^5	9.4×10^{-5}	<0.94	<0.003	34
Polycyclic aromatic hydrocarbons						
Acenaphthene	100.0	4.6×10^3	0.44	<1.7	--	2.8×10^{-6}
Acenaphthylene	27.0	2.5×10^3	0.22	<1.7	--	2.8×10^{-6}
Anthracene	170.0	1.4×10^4	0.24	<1.7	--	2.8×10^{-6}

TABLE 2-4

CONCENTRATIONS OF PRIORITY POLLUTANTS IN SEDIMENTS OF THE GRAND CALUMET RIVER SYSTEM, THE CORRESPONDING K_{oc} VALUES, AND THE USEPA WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE AND HUMAN HEALTH
(Continued)

Pollutant	Sediment concen-tration$^{(1)}$ (ug/g)	K_{oc}	Inter-stitial water concen-tration (mg/l)	Aquatic life criteria		Human health criteria$^{(3)}$ (mg/l)
				acute$^{(2)}$ (mg/l)	chronic (mg/l)	
Polycyclic aromatic hydrocarbons (cont'd)						
Benzo[a]anthracene	140.0	2.0×10^5	0.01	<1.7	--	2.8×10^{-6}
Benzo[b]fluoranthene	200.0	5.5×10^5	7.1×10^{-3}	<1.7	--	2.8×10^{-6}
Benzo[k]fluoranthene	120.0	5.5×10^5	4.2×10^{-3}	<1.7	--	2.8×10^{-6}
Benzo[g,h,i]perylene	38.0	1.6×10^6	4.7×10^{-4}	<1.7	--	2.8×10^{-6}
Benzo[a]pyrene	200.0	5.5×10^6	1.9×10^{-3}	<1.7	--	2.8×10^{-6}
Chrysene	130.0	2.0×10^5	1.2×10^{-2}	<1.7	--	2.8×10^{-6}
Dibenzo[a,h]anthracene	11.0	3.3×10^6	7.0×10^{-5}	<1.7	--	2.8×10^{-6}
Fluoranthene	120.0	3.8×10^4	6.0×10^{-2}	<4.0	--	0.042
Fluorene	98.0	3.9×10^3	0.48	<1.7	--	2.8×10^{-6}
Indeno(1,2,3-cd)pyrene	6.8	1.6×10^6	8.5×10^{-5}	<1.7	--	2.8×10^{-6}
Naphthalene	33.0	940	0.70	<1.7	--	2.8×10^{-6}
Phenanthrene	200.6	1.4×10^4	0.29	<1.7	--	2.8×10^{-6}
Pyrene	65.0	3.8×10^4	0.03	<1.7	--	2.8×10^{-6}

TABLE 2-4

CONCENTRATIONS OF PRIORITY POLLUTANTS IN SEDIMENTS OF THE GRAND CALUMET RIVER SYSTEM, THE CORRESPONDING K_{oc} VALUES, AND THE USEPA WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE AND HUMAN HEALTH
(Continued)

Pollutant	Sediment concentration(1) (ug/g)	K_{oc}	Interstitial water concentration (mg/l)	Aquatic life criteria acute(2) (mg/l)	Aquatic life criteria chronic (mg/l)	Human health criteria(3) (mg/l)
Nitrosamines						
N-Nitrosodiphenylamine	1.1	2.4×10^3	9.2×10^{-3}	<5.8	--	0.49
Phenol	1.66	14.2	2.2	<10.2	<2.6	35
Metals(4)						
Antimony	80.0	--	--	<9.0	<1.6	0.146
Arsenic	36.7	1.3 ± 1.2	440	0.440	0.040	2.2×10^{-6}
Barium	96(5)	--	--	--	--	--
Beryllium	2.0	--	--	<0.130	5.3×10^{-3}	3.7×10^{-6}
Cadmium	18.0	6.4 ± 8.6	58.1	1.53×10^{-3}	5.7×10^{-4}	--0.010
Chromium	1,330.0	--	89.2	0.021	2.9×10^{-4}	1.7×10^2
Copper	710.00	170.0 ± 210	--	0.0324	5.4×10^{-3}	--
Cyanide	21.77	--	--	0.052	3.5×10^{-3}	0.2
Iron	128,710(5)	--	367	--	--	--
Lead	854.0	38.0 ± 40	--	0.2823	9.92×10^{-3}	0.050
Manganese	1,625(5)	--		--	--	--

TABLE 2-4

CONCENTRATIONS OF PRIORITY POLLUTANTS IN SEDIMENTS OF THE GRAND CALUMET RIVER SYSTEM, THE CORRESPONDING K_{oc} VALUES, AND THE USEPA WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE AND HUMAN HEALTH

(Continued)

Pollutant	Sediment concentration(1) (ug/g)	K_{oc}	Interstitial water concentration (mg/l)	Aquatic life criteria acute(2) (mg/l)	Aquatic life criteria chronic (mg/l)	Human health criteria(3) (mg/l)
Metals(4) (cont'd)						
Mercury	2.44	0.8 ± 1.1	64.6	1.7×10^{-6}	5.7×10^{-7}	1.44×10^{-2}
Nickel	670.0	--	--	7.83×10^{-3}	4.87×10^{-4}	0.013
Selenium	7.3	--	--	0.260	0.035	0.010
Silver	19.0	--	--	8.15×10^{-3}	$<1.2 \times 10^{-4}$	0.050
Thallium	90.0	--	--	<1.4	<0.040	0.013
Zinc	1,465.0	33.0 ± 63	855	0.450	<0.047	--

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(1) Source: USEPA 1980, except where otherwise indicated.

(2) Due to the lack of aquatic toxicity information for most of the polycyclic aromatic hydrocarbons (PAHs), the most conservative number available (based on tests with acenaphthene) was selected for use in this table. It is suspected that the toxicity of other PAHs would increase (meaning criteria value would be progressively lower) as the number of benzoid rings increases.

(3) For some compounds, the human health criterion is based on the potential carcinogenic effects of the material. The value expressed in the table is the level which may result in an incremental increase in cancer risk of 10^{-6} over a lifetime.

(4) USEPA November 28, 1980 criteria were used for all of the metals rather than the more recent criteria published February 7, 1984, because the 1984 criteria are expressed as active metal and the available data are expressed as total metal.

(5) Source: 1980 study conducted by the Great Lakes National Program Office of USEPA (USEPA 1982).

TABLE 2-5

RANKING OF PRIORITY POLLUTANT ORGANICS AND METALS FOUND IN THE GRAND CALUMET RIVER SEDIMENTS BASED ON A COMPARISON OF SEDIMENT CONCENTRATIONS AND USEPA WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE

Compound	Score
Ranking based on acute toxicity	
Aroclor 1248	0.61
Naphthalene	0.41
Fluorene	0.28
Acenapthene	0.26
Phenol	0.22
Phenanthrene	0.17
Anthracene	0.14
Acenapthylene	0.13
Arochlor 1254	0.13
Pyrene	0.02
Fluoranthene	1.5×10^{-2}
Benzo[a]anthracene	8.0×10^{-3}
Chrysene	7.6×10^{-3}
Benzo[b]fluoranthene	4.2×10^{-3}
Bis(2-ethylhexyl)phthalate	4.2×10^{-3}
Benzo[a]pyrene	3.2×10^{-3}
Benzo[k]fluoranthene	2.5×10^{-3}
N-Nitrosodiphenylamine	1.6×10^{-3}
1,4-Dichlorobenzene	1.5×10^{-3}
1,2-Dichlorobenzene	4.7×10^{-3}
Benzo[g,h,i]perylene	2.8×10^{-4}
Di-N-butyl phthalate	1.0×10^{-4}
Butyl benzyl phthalate	7.5×10^{-5}
Indeno(1,2,3-cd)pyrene	5.0×10^{-5}
Dibenzo[a,h]anthracene	4.1×10^{-5}
Di-N-octyl phthalate	2.8×10^{-7}
Ranking based on chronic toxicity	
Arochlor 1248	85.7
Arochlor 1254	18.8
Bis(2-ethylhexyl)phthalate	1.0
Phenol	0.07
Di-N-butyl phthalate	0.03
Butyl benzyl phthalate	0.02
1,4-Dichlorobenzene	2.1×10^{-3}
1,2-Dichlorobenzene	5.8×10^{-4}
Di-N-octyl phthalate	8.9×10^{-5}

TABLE 2-5 (Continued)

RANKING OF PRIORITY POLLUTANT ORGANICS AND METALS FOUND IN THE GRAND CALUMET RIVER SEDIMENTS BASED ON A COMPARISON OF SEDIMENT CONCENTRATIONS AND USEPA WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE

Compound	Score
Ranking based on acute toxicity	
Mercury	3.5×10^7
Cadmium	3.8×10^4
Copper	2.6×10^3
Zinc	1.9×10^3
Lead	1.6×10^3
Arsenic	1.0×10^3
Ranking based on chronic toxicity	
Mercury	1.1×10^8
Cadmium	1.0×10^5
Copper	4.5×10^4
Zinc	1.9×10^4
Nickel	1.5×10^4
Arsenic	1.2×10^4

TABLE 2-6

RANKING OF PRIORITY POLLUTANT ORGANICS AND METALS FOUND IN THE GRAND CALUMET RIVER SEDIMENTS BASED ON A COMPARISON OF SEDIMENT CONCENTRATIONS, AND USEPA WATER QUALITY CRITERIA FOR THE PROTECTION OF HUMAN HEALTH

Compound	Score
Non-Carcinogens	
Lead	9.0×10^3
Cadmium	5.6×10^3
Mercury	4.2×10^3
Fluoranthene	1.5
Phenol	6.7×10^{-2}
1,4-Dichlorobenzene	4.1×10^{-3}
1,2-Dichlorobenzene	1.2×10^{-3}
Di-N-butyl phthalate	2.7×10^{-6}
Carcinogens	
Arsenic	2.6×10^8
Naphthalene	$2.5 \mathrm{X} 10^5$
Acenaphthene	$1.6 \mathrm{X} 10^5$
Fluorene	$1.8 \mathrm{X} 10^5$
Phenanthrene	$1.02 \mathrm{X} 10^5$
Anthracene	8.7×10^4
Acenaphthylene	$7.7 \mathrm{X} 10^4$
Arochlor 1248	$1.5 \mathrm{X} 10^4$
Pyrene	1.2×10^4
Benzo[a]anthracene	5.0×10^3
Chrysene	4.6×10^3
Arochlor 1254	3.3×10^3
Benzo[b]fluoranthene	2.6×10^3
Benzo[h]fluoranthene	1.7×10^3
Benzo[a]pyrene	260
Benzo[g,h,i]perylene	170
Indeno[1,2,3-cd]pyrene	30
Dibenzo[a,h]anthracene	24
N-Nitrosodiphenylamine	1.9×10^{-2}

criteria for the protection of aquatic life and human health. In Table 2-5, contaminants of concern are ranked based upon scores derived using the equation discussed in this section and aquatic life criteria. In Table 2-6, contaminants are ranked based upon scores derived using the equations and the human health criteria.

The most recent aquatic life water quality criteria for metals (USEPA 1984) were not used in this evaluation. Although the 1984 criteria are based on the most recent toxicological data, they are expressed as dissolved or "active" metal and the Hydroqual monitoring data available for use in this evaluation are expressed as total metal. Where water quality criteria values were not available for specific compounds, LC_{50} values for the most sensitive organism tested were presented. These values appear in the tables with a "less than" symbol because, based on EPA's current methodology for criteria derivation (USEPA 1982), all water quality criteria are set at levels less than results of toxicity tests for the most sensitive species. Due to the lack of aquatic toxicity information for most of the polycyclic aromatic hydrocarbons (PAHs), the most conservative LC_{50} value available (based on toxicity tests with acenapthene) was selected as the criterion for the PAHs. It is suspected that this number will underestimate the toxicity of PAHs which have a greater number of benzoid rings than acenapthene (Haque 1980).

Based on the scoring system used in this report, the sediment contaminants of greatest concern to aquatic life are the heavy metals (particularly mercury and cadmium), Aroclors 1248 and 1254 (PCBs), the two- and three-membered ring PAHs (e.g., napthalene, fluorene), phenol and bis (2-ethylhexyl) phthalate. Using human health criteria as the basis of scoring, the non-carcinogenic sediment contaminants of greatest concern are the heavy metals (scores could be calculated only for mercury, cadmium and lead). Carcinogenic contaminants that rank highest are arsenic, the two- and three-ring PAHs and Aroclor 1248.

As discussed previously, the scoring and ranking of the sediments of the GCR/IHR constitutes only a preliminary and qualitative assessment of the sediment contamination problem. Given the lack of available data, it is not possible to meaningfully project risks to aquatic life or human health. The results of the ranking of sediment contaminants should be used only as an indicator of compounds that may be of concern and those for which additional monitoring data would be valuable.

Use of the scoring system developed for this assessment identifies compounds of concern as a function of estimated water column concentrations as based on partitioning between sediment and water phases. However, scoring does not reflect risks to aquatic life of direct contact with sediments (e.g., through ingestion), or of bioaccumulation or biomagnification of contaminants. Although it is possible to project the potential for bioaccumulation using physical/chemical parameters of the identified sediment contaminants (e.g., solubility, octanol-water partition coefficients, sediment-water partition coefficients), this information is of limited value in the absence of reliable data on the abundance and distribution of indigenous species, and of food chain dynamics.

2.2.5 Biota

Presently, the State of Indiana classifies the Grand Calumet River system as suitable for "limited aquatic life." This classification, last reviewed in 1978, must either be revised to "full fish and aquatic life" by the State or the State must conduct a use attainability analysis to determine the classification which can be met in the river.

Natural obstacles inhibit the quality of biological habitat in portions of the system. Foremost of these is the tendency of the slow flowing West Branch to stagnate, becoming excessively warm and oxygen deficient, when periodic lake-level changes cause the river to temporarily back up. Under these transient conditions, particulate matter settles to the bottom, silting over detrital material and suffocating bottom dwelling animals. While these conditions are typical of many Great Lakes stream mouth environments, the effects are exaggerated in the West Branch.

Flow reversals have less impact on the East Branch and Main Stem of the Grand Calumet because of the high lakeward rate of flow sustained by industrial effluent discharges, particularly at the U.S. Steel plant in Gary. Without the high industrial flows, the majority of the Grand Calumet system would probably be much less suitable for fish and aquatic life (assuming adequate control of pollutants in those effluent). The turbulence and flushing action assisted by industrial discharges encourages re-oxygenation of the river.

Another obstacle to fish and aquatic life potential in the system is the intensity of urban and industrial development within the watershed. Most of the precipitation falling on the basin presently is captured in roof drains, parking lots, roadways and storage yards and thence diverted to the river through stormwater sewers. Three impacts result from this: 1) reduced opportunity for soil filtering of dissolved and suspended pollutants; 2) exaggerated peak flows and skewed storm flow hydrographs, followed by depressed low flows; and 3) reduced dilution of groundwater contaminants and slower dispersion from origin to points of discharge along the river.

One positive aspect of the biological habitat of this area is the existence of a number of wetland, bog and dune habitat areas adjacent to the river. These areas may serve as spawning and rearing areas for many important fish species. The river-contiguous marshes listed in the Lake Michigan Federation Report on the Grand Calumet River (Lake Michigan Federation 1984), are especially important to the biological future of the river.

Further, the Marquette Park lagoons, located at the headwaters of the GCR, may represent a natural reserve of indigenous species which could contribute to the recolonization of the river, with improving habitat conditions. At present, these lagoons are reported to be largely isolated from the river by partially constricted culverts on U.S. Steel property. These and other natural areas along the GCR/IHC are depicted in Figure 2-3.

A biological survey of the Grand Calumet River waters would likely have been a summarily unproductive search prior to 1970. A survey of benthic macroinvertebrate organisms of the Grand Calumet conducted in 1973 (CMSD 1980) referenced the observation that residues from waste acid pickle liquors once covered the bottom of the river. During the early 1960's, for example, only 22 to 108 oligochaetes (aquatic earthworms) per square meter were found in Harbor Mouth sediments. In 1973, the density of these organisms were found to range between 2,400 to 500,000 per square meter in the same area. Although the presence of large numbers of oligochaetes is often interpreted as an indication of a pollution stressed environment, the increase in density of these pollution tolerant organisms is interpreted as an indication of amelioration in environmental conditions. Even in 1973, however, the appearance of the harbor sediment was reported as "black mud", closely resembling crude oil; oily substances were observed in several of the harbor and canal stations (CMSD 1980).

Because of the substantial increases observed in macroinvertebrate densities from the 1960's to 1973, it is logical to anticipate that this presence of fish food organisms would encourage the reestablishment of a native fish population. A recent fish survey sponsored by the U.S. Army Corps of Engineers (COE 1984) suggest that this may have occurred. Fish species captured in the Indiana Harbor Ship Canal during this survey are presented in Table 2-7. Resident fish cannot be distinguished with certainty from migrants, based on the COE data. However, a preponderance of fish collected were young-of-the-year of species known to inhabit nearby areas of Lake Michigan. They do not represent a stable fish population, and are probably migrants.

Yellow perch were by far the most abundant gamefish in the IHC in this survey, comprising as much as 29 percent of the total number captured at a single sampling station. Sampling of the GCR was not performed in this survey.

The Marquette Park lagoons are connected to the GCR by up to 1800 feet of culvert, crossing U.S. Steel property. The existing Indiana DNR permit for this culvert (Docket #636; issued 1958) specifies that a 50 cfs flow capacity be maintained. This culvert is reportedly constricted and passing little

TABLE 2-7

FISH SPECIES COLLECTED FROM THE INDIANA HARBOR CANAL DURING NOVEMBER AND DECEMBER 1983

Fish Species Collected	
Species Name	Common Name
Alosa pseudoharengus (Wilson)	Alewife
Dorosoma cepedianum (Lesueur)	Gizzard shad
Umbra limi (Kirtland)	Central mudminnow
Carassius auratus (Linnaeus)	Goldfish
Cyprinus carpio (Linnaeus)	Carp
C. auratus x *C. carpio*	Goldfish x Carp hybrid
Notemigonus crysoleucas (Mitchill)	Golden shiner
Notropis atherinoides (Rafinesque)	Emerald shiner
Notropis hudsonius (Clinton)	Spottail shiner
Pimephales notatus (Rafinesque)	Bluntnose minnow
Pimephales promelas (Rafinesque)	Fathead minnow
Lepomis cyanellus (Rafinesque)	Green sunfish
Lepomis gibbosus (Linnaeus)	Pumpkinseed
Lepomis macrochirus (Rafinesque)	Bluegill
Pomoxis nigromaculatus (Lesueur)	Black crappie
Perca flavescens (Mitchell)	Yellow perch

water to the GCR. Opening this culvert could contribute relatively clean water to the headwaters of the GCR, which would affect dilution of downstream contaminant sources as well as enhancing "flushing" of the waterway. These lagoons could also represent a source of biota for recolonization of the river. Reopening of the culvert could be affected under the existing authority of the Indiana DNR and the City of Gary.

While biological habitat improvement is certainly indicated by the presence of dense macroinvertebrate populations as well as perch and other panfish in the Canal and Harbor, the potential issue of toxins transfer from the sediments to the fish, via bottom dwelling food organisms, is significant. These organisms may bioaccumulate and bioconcentrate toxins from the sediments. This issue should be addressed in any future biological studies.

Corollary concerns include whether it is cost-effective to control the discharge of oxygen-demanding substances to the river, to improve biological habitat, when 1) toxics are entering the water and sediments from existing discharges; and 2) high levels of toxins and toxin-producing chemicals are present in the sediments and may be accumulating in aquatic organisms. As reflected in the discussions contained in Section 2.2.4 of this report, relatively little is known regarding the dynamics of biological contaminant movement in the GCR/IHC.

2.3 POLLUTANT SOURCES

Historically, industrial and municipal wastewater outfalls have been regarded as the principal sources of contaminants to the GCR/IHC. While this may be true for oxygen demanding contaminants, other sources may be of equal importance when considering toxic materials input. This section assesses the point and non-point sources contributing pollutants to the GCR/IHC. Additional information describing the pollutant characteristics and NPDES program discharge limitations on the municipal and principle industrial point source discharges to the GCR/IHC is presented in Section 3.2 of this report.

2.3.1 Industrial Point Sources

Industrial point sources have been classified by the USEPA as either major or minor dischargers. Based on a review of National Pollutant Discharge

Elimination System (NPDES) records maintained by the Agency, seven major industries discharge into the GCR/IHC system, including:

- Citgo Petroleum Corporation
- E.I. du Pont de Nemours and Company
- Inland Steel Corporation
- Jones and Laughlin Steel Company
- U.S.S. Lead Refinery, Inc.
- United States Steel Corporation
- Vulcan Materials Company.

There are also several minor industrial point sources, including: Industrial Disposal, American Steel Foundries, Blaw Knox Foundry, and Explorer Pipeline Company. A brief description of each major industrial point source is provided in the following discussion. This information is based on the NPDES permits and recent ISBH sampling data.

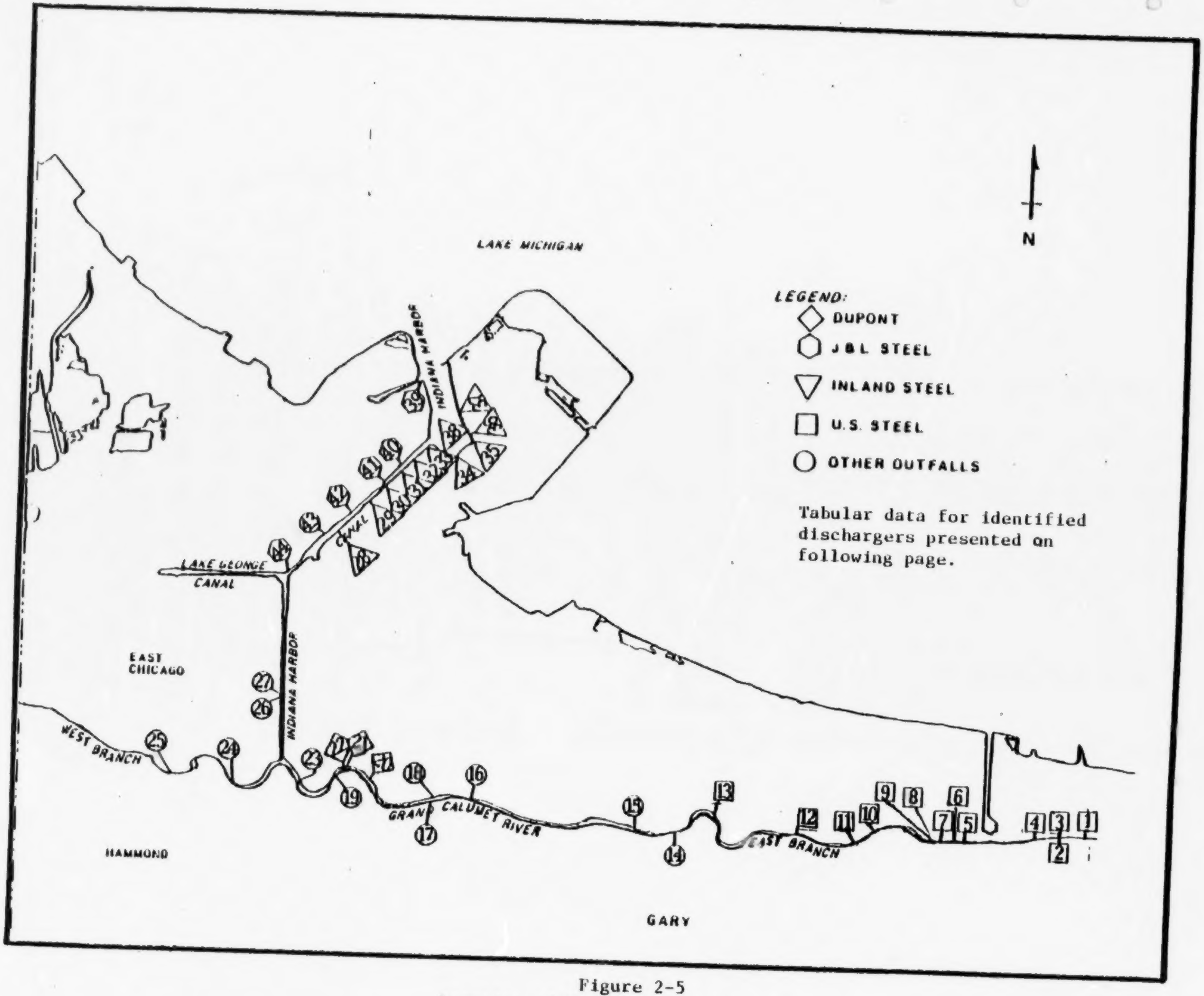
NPDES effluent limitations reported in the following discussion represent 30 day average values unless stated otherwise. ISBH data represent average effluent values obtained from two separate samplings in 1983. Average effluent values for each of the seven major dischargers are summarized in Table 2-8, which is presented following the discussion of individual dischargers. Locations of NPDES-permitted industrial point source dischargers to the GCR/IHC are depicted in Figure 2-5.

Citgo Petroleum Corporation

Citgo Petroleum Corporation is a petroleum storage facility used for receipt and distribution of petroleum products, via pipeline systems. The company has one outfall to the Grand Calumet River through which it discharges collected surface runoff following treatment by an oil/water separator. NPDES effluent limitations limit oil and grease to 10 mg/l and pH to between 6 and 9.

E.I. du Pont de Nemours and Company

E.I. du Pont manufactures inorganic industrial chemicals, including herbicides and fungicides. Non-contact cooling water and process wastewaters are discharged to the GCR from these permitted outfalls. Wastewaters are also discharged to the East Chicago Sanitary District. Based on 1983 sampling


N
LAKE MICHIGAN
LEGEND:
DUPONT
J & L STEEL
INLAND STEEL
U.S. STEEL
OTHER OUTFALLS
INDIANA HARBOR
CANAL
LAKE GEORGE CANAL
EAST CHICAGO
HAMMOND
GARY
WEST BRANCH
GRAND CALUMET RIVER
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Tabular data for identified dischargers presented on following page.

Figure 2-5
Location of Point Source Discharges

Modified from ISBH 1984

Legend for Figure 2-5

Map #	Source	Type of Discharge	Flow (MGD)
1.	U.S. Steel	P/C	60
2.	↓	C	2
3.	↓	P/C	14
4.	↓	P	5
5.	↓	C	1
6.	↓	C	55
7.	↓	C	70
8.	↓	P/C	90
9.	↓	P	35
10.	↓	P/C	90
11.	↓	C	7
12.	↓	C	3
13.	↓	P/C	14
14.	Gary STP	P	60
15.	Industrial Disposal		M.D.
16.	Vulcan Materials	P/C	N.A.
17.	Explorer Pipe		M.D.
18.	Citgo Petroleum	C	M.D.
19.	Harbison-Walker		M.D.
20.	Dupont	C	5
21.	↓	P	5
22.	↓	P	5
23.	U.S.S. Lead	P	.06
24.	E. Chicago STP	P	20
25.	Hammond STP	P	48
26.	Blaw-Knox	P	2.2 tgd
27.	↓	P	2.2 tgd
28.	Inland Steel	P/C	1
29.	↓	P/C	135
30.	↓	P/C	8
31.	↓	P/C	13
32.	↓	P/C	30
33.	↓	C	45
34.	↓	C	90
35.	↓	P/C	18
36.	↓	P	42
37.	↓	P/C	30
38.	↓	P/C	130
39.	J&L Steel	P	57
40.	↓	C	46
41.	↓	C	43
42.	↓	C	2
43.	American Steel	C	.22
44.	J&L Steel	P	9

Notes

P= Process wastewater, treated process wastewaters, and/or contact cooling waters

C= Non-contact cooling waters, and/or stormwater runoff

P/C=Outfall discharges both types of waters

M.D.= Minor discharge

MGD= Million gallons per day

tgd= thousand gallons per day

data, this facility discharges approximately 4.7 mgd of wastewater, with the following general characteristics: 4 mg/l of BOD, 0.005 mg/l of phosphorus, 29 mg/l of chlorides, 1,340 mg/l of TDS, 865 mg/l of sulfates and trace amounts of lead (ISBH 1984).

Inland Steel Corporation

The Inland Steel Corporation plant in East Chicago is an integrated steel and coke production facility. The plant produces iron, coke, coal chemicals, steel and steel products, as well as a portion of its own electricity. The facility has thirteen permitted outfalls discharging into the Indiana Harbor Canal and Indiana Harbor, and two permitted underground injection wells. The discharges consist of cooling waters and process wastewaters amounting to more than 500 mgd. Wastewater treatment is provided for industrial process waters and sanitary wastewaters. About 150 mgd of cooling and treated process waters are recycled within the plant. Some wastewaters are also discharged to the East Chicago Sanitary District.

The 1983 ISBH survey found this facility to be discharging about 592 mgd of wastewater from its permitted outfalls. The wastewater quality discharged from this facility averages: 5 mg/l of BOD, 0.4 mg/l of ammonia, 0.03 mg/l of phosphorus, 17 mg/l of chlorides, 186 mg/l of TDS, 27 mg/l of sulfates, 0.008 mg/l of cyanides, 0.07 mg/l of iron and 0.006 mg/l of phenols (ISBH 1984).

Jones and Laughlin Steel Company

The Jones and Laughlin Steel Company's Indiana Harbor Works, formerly owned by Youngstown Sheet and Tube Company, manufacturers sheet, tube and structural steel shapes. The facility has nine permitted outfalls which discharge about 200 mgd of cooling process waters into the Indiana Harbor Canal. Another 57 mgd, which was discharged prior to 1981, is recycled within the plant. About 9 mgd of process wastewaters receive physical-chemical treatment prior to discharge. Coke plant and sanitary wastewaters are also discharged to the East Chicago POTW. Based on 1983 sampling data, this facility discharges approximately 154 mgd from its permitted outfalls. The average pollutant characteristics of the discharge are: 4 mg/l of BOD, 0.4 mg/l of ammonia, 0.04 mg/l of phosphorus, 40 mg/l of chlorides, 261 mg/l of TDS, 39 mg/l of sulfates, and 0.02 mg/l of cyanides (ISBH 1984).

U.S.S. Lead Refinery, Inc.

U.S.S. Lead Refinery, Inc. has one permitted outfall discharging to the Grand Calumet River. Some wastewaters are also discharged to the East Chicago Sanitary District. A 1974 waste load allocation study indicated that the discharge was "completely non-contact cooling water," but that sulfates "infiltrate into the drainage pipe from battery storage areas." Data fron the 1983 ISBH survey indicate that about 0.06 mgd of wastewater is discharged from the facility. The average discharge characteristics are: 8 mg/l of BOD, 190 mg/l of chloride, 805 mg/l of TDS, and 520 mg/l of sulfates (ISBH 1984).

United States Steel Corporation

The Gary Works and Tubing Specialities facility, operated by U.S. Steel, produces iron and steel products, coke, coal chemicals, seamless tube rounds, and steel foundry products. The facility has 20 permitted outfalls discharging into the Grand Calumet river, five permitted outfalls discharging into Lake Michigan and an on-site, permitted, injection well. Approximately 350 mgd of cooling water and process wastewaters are discharged from the outfalls entering the GCR, and an additional 91 mgd is recycled within the facility. Treatment is provided for process wastewaters and some cooling waters. Based on data from the 1983 survey, an average of 309 mgd of wastewater is discharged to the GCR from the facility's permitted outfalls. The average characteristics of these outfalls are: 4 mg/l of BOD, 0.3 mg/l of ammonia, 0.04 mg/l of phosphorus, 23 mg/l of chlorides, 204 mg/l of TDS, 26 mg/l of sulfates, 0.25 mg/l of iron and trace amounts of cyanides and phenols (ISBH 1984).

Vulcan Materials Company

The Vulcan Materials Company recycles tin plated scrap metals into steel bundles and tin ingots. One permitted outfall discharges to the Grand Calumet River. Based on NPDES permit data, average flow from this facility is about 0.03 mgd and consists of non-contact cooling water, softener regeneration and boiler blow down waters, and periodic stormwater. However, based on 1983 ISBH survey data, approximately 0.12 mgd is discharged from the plant. The wastewater was characterized as containing: 14 mg/l of BOD, 950 mg/l of chlorides, 1660 mg/l of TDS and 42 mg/l of sulfates (ISBH 1984).

Minor Dischargers

Industrial point source loadings from minor dischargers are summarized in Table 2-8. Based on this data, the only important discharger in this group is Industrial Disposal Company. This facility is a landfill discharging 5,000 to 10,000 gpd of seepage, as well as storm water runoff. Filling material utilized at the site are sand, concrete and brick. The 1983 ISBH survey found the facility to be discharging 1 mgd, with pollutant concentrations estimated at the following levels: 15 mg/l of BOD, 0.35 mg/l of phosphorus, 1,122 mg/l of chlorides, 2,825 mg/l of TDS, and 357 mg/l of sulfates (ISBH 1984).

A summary of the pollutant contributions from the major and minor industrial point sources just described is provided in Table 2-8. It can be seen from this table that the greatest mass of pollutants is discharged by three steel mills: Inland Steel, Jones & Laughlin Steel and U.S. Steel. The combined wastewater flow from these three sources (1,056 mgd) accounts for about 90 percent, by flow, of all point sources discharging into the GCR/IHC. Since most of this wastewater is non-contact cooling water, the water quality (as measured by the 1983 ISBH survey) is quite good. In fact, the BOD loading from these three significant industrial point sources was less than that from the Gary or East Chicago POTWs.

The data presented in the 1983 ISBH survey includes conventional pollutants, non-conventional pollutants and a few metals. Additional measurements for metals and toxic organics are required to adequately determine the impact of industrial point sources on the GCR/IHC.

2.3.2 Municipal Wastewater Sources

Three municipal wastewater treatment plants, serving the East Chicago, Gary and Hammond Sanitary Districts, discharge into the GCR/IHC system. However, due to flow patterns in the West Branch, the Hammond POTW effluent enters that portion of the GCR which drains to the IHC only under conditions of high rainfall (USEPA 1982). Brief descriptions of each of these plants, their NPDES limitations, and pollutants loadings to the GCR/IHC are provided in this section. Discharge locations of these POTWs to the GCR/IHC are provided in Figure 2-5.

TABLE 2-8
INDUSTRIAL POINT SOURCE LOADINGS
ISBH (1984) SURVEY

Industry	Flow	BOD	Ammonia	Phosphorus	Chlorides	TDS	Sulfates	Cyanides	Iron	Phenols	Lead
Citgo	-	-	-	-	-	-	-	-	-	-	-
DuPont	4.70	157	-	0.2	1,137	52,486	33,935	-	-	-	-
Inland Steel	592	23,704	1,977	147	85,322	919,578	135,306	39	352	31	0
J & L Steel	154	5,195	484	47	51,878	335,274	50,059	32	0	9	-
U.S.S. Lead	0.06	4	-	-	95	403	260	-	-	-	-
U.S. Steel	309	10,710	827	107	58,221	525,617	66,572	3	637	6	0
Vulcan Materials	0.12	14	-	-	950	1,661	42	-	-	-	-
Industrial Disposal	1.00	127	-	3	9,365	23,567	2,977	-	-	-	-
American Steel	0.13	2	-	-	39	358	69	-	1	-	-
Blaw Knox	0.04	4	-	-	24	140	33	-	-	-	-
Explorer Pipeline	-	-	-	-	-	-	-	-	-	-	-
Totals											

Notes: All water quality parameters shown in lbs/day. (mg/l = lbs/day x $\frac{1}{8.34}$ x $\frac{1}{\text{Flow}}$)

- indicates parameter not measured
0 indicates parameter measured to be zero
Flow is in mgd

East Chicago

The East Chicago Facility is a 20 mgd, conventional activated sludge facility, using alum addition for phosphorus removal. Flow from the final clarifiers discharges into a 20 acre lagoon which also receives wastewater diverted from the Magoun Combined Sewer Overflow Station. Wastewater from the lagoon is subject to seasonal chlorination prior to final discharge to the Grand Calumet River. The effluent contains typical conventional and non-conventional pollutants: BOD, TSS, oil and grease, phosphorus, and ammonia. Other constituents are chlorides, fluorides, cyanide and sulfate.

Historical data provided by the East Chicago Sanitary District indicate increased average flows over the last 15 years. This trend is reflected in the following example data:

1968	11.31 mgd
1976	12.93 mgd
1982	16.70 mgd
1983	15.63 mgd

The 38 percent flow increase observed over this 15-year period has occurred despite the elimination of discharges from a number of large industries, including M&T Chemicals/MRI Corporation, Inland Steel Coke Plant #3, and Railoc of Indiana, Inc.

Comparing 1968 and 1982 average effluent data, BOD concentrations decreased by 50%, from 146 to 73 mg/l. Although TSS concentrations also decreased during this period, the increment was much smaller (approximately 10%), dropping from 110 mg/l in 1968 to 99 mg/l in 1982. Due to increases in flow rates during this same period, however, total effluent loading reductions to the GCR/IHC were not as dramatic. For BOD, the 1982 loading rate of 10,415 lbs/day was only 25% less than the 13,746 lbs/day 1968 value. TSS loading actually increased during this period, from 10,399 lbs/day in 1968 to 15,013 lbs/day in 1982 (a 44% increase).

Little historical data exists on the amount of toxic pollutants discharged by the East Chicago treatment plant. As part of pretreatment program development, East Chicago collected composite samples of the influent, effluent and sludge for three consecutive days in the spring of 1984. These samples were analyzed for the list of 126 priority pollutants. Those pollutants detected in the wastewater are listed in Table 2-9. The loadings presented in the table were calculated using the 1983 average daily flow of 15.63 mgd.

To aid in evaluating the impact of the East Chicago discharge on the GCR, the USEPA conducted bioassay and mutagenicity testing of the POTW's discharge in February, 1980. Analysis of the results of acute, static bioassays indicated the effluent to be highly toxic to fish, and mutagenicity testing of concentrated (100x and 200x) effluent samples indicated the presence of mutagenic compounds. These preliminary data indicate the need for more in-depth, conclusive studies.

Gary

The Gary facility is a 60 mgd advanced wastewater treatment plant. The plant uses an activated sludge process with two-stage nitrification, phosphorus removal, and sand filtration. The following pollutants may be discharged from this facility under the NPDES permit conditions: BOD, SS, phenol, phosphorus, fluoride, chloride, sulfate, ammonia, oil and grease, and cyanide.

Historical data provided by the Gary Sanitary District indicate a reduction in treated flow over the last 15 years, from an annual average of 48.5 mgd in 1968 to 41.4 mgd in 1982. Effluent quality, in terms of BOD and TSS, has improved over the same period. Daily BOD loadings to the GCR/IHC have been reduced by 32%, from 4,589 lbs/day in 1968 to 3,107 lbs/day in 1982. Over this same period, TSS loadings have decreased by 75%, from 8,475 lbs/day to 2,072 lbs/day. Additional improvements occurred in 1983 and 1984, following installation of new equipment at the POTW. However, treatment plant performance has been somewhat erratic, due to operation and maintenance problems.

TABLE 2-9
INFLUENT AND EFFLUENT PRIORITY POLLUTANT MONITORING DATA FOR THE EAST CHICAGO POTW

Pollutant	1984 Influent mg/l	1984 Effluent mg/l	1984 Effluent Loading(1) lbs/day
Arsenic	<0.1	<0.05	<6.52
Cadmium	<0.05 - 0.1(2)	<0.01 - 0.01	≤1.30
Chromium	<0.05	<0.05	<6.52
Cyanides	<0.025 - 0.099	0.033 - 0.11	4.30 - 14.34
Lead	0.18 - 0.73	<0.05	<6.52
Mercury	<0.0005 - 0.0006	<0.0005	<0.07
Phenols	0.035 - 0.52	<0.02	<2.61
Selenium	<0.1	<0.01	<1.30
Silver	<0.05 - 0.1	<0.05	<6.52
Antimony	0.2 - 0.5	<0.05	<6.52
Beryllium	<0.05	<0.05	<6.52
Copper	0.5 - 2.1	<0.05	<6.52
Nickel	<0.05	<0.05	<6.52
Thallium	<1 - 3.2	0.1 - 0.6	13.04 - 78.21
Zinc	0.6 - 2.8	<0.1	<13.04
Barium	0.3 - 0.4	<0.05	<6.52
Methylene Chloride	<0.010 - 0.013	<0.010 - .066	≤1.69
1,1,1,-Trichloroethane	0.016 - .025		
Benzene	<0.010 - .016		
Toluene	<0.010 - 0.023		
Phenol	0.13 - 0.48 -16.95(3)		
4,-Nitrophenol		<0.025 - 0.028	≤3.65
Naphthalene	0.018-0.030		
Fluorene	<0.010 - 0.013		
Phenanthrene		<0.010 - 0.041	≤5.34
Fluoroanthene		<0.010 - 0.040	≤5.21
Pyrene		<0.010 - 0.033	≤4.30
Benzo (A) Anthracene		<0.010 - 0.021	≤2.74
Chrysene		<0.010 - 0.017	≤2.22
Bis(2-Ethylehexyl) Phthalate	<0.010 - 0.026		

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(1) Assumes 15.63 mgd average 1983 flow.

(2) Two values reflect maximum and minimum concentrations for three composite samples collected over a three-day sampling period.

(3) Three values represent observed concentrations for each of three consecutive daily samples collected over a three-day sampling period.

Very little data is available on levels of toxic pollutants discharged by the Gary treatment plant. Composite samples of the influent and effluent were collected on three randomly selected days over a two-week period in May, 1981. The samples were analyzed for the 126 priority pollutants. Sample analysis results are reported in Table 2-10. Only those pollutants detected in the wastewater are listed in Table 2-10. The loadings presented in the table were calculated using a daily average flow of 40 mgd.

Hammond

The Hammond facility is an AWT facility using the activated sludge process, with the Kraus modification, followed by multimedia filtration and chlorination. The average design flow is 48 mgd.

The addition of tertiary treatment in mid-1977 resulted in dramatic reductions in pollutant loadings from this facility, as shown below:

	1968	1976	1982
Ave Flow	33.4 mgd	36.6 mgd	37.9 mgd
BOD	38.9 mg/1	17.0 mg/1	1.7 mg/1
TSS	36.6 mg/1	29.8 mg/1	1.9 mg/1

These data represent a 96 percent reduction in BOD loading, and a 95 percent reduction in solids loading to the GCR/IHC from 1968 to 1982.

Composite samples were collected on the influent and effluent of the Hammond treatment plant on three consecutive days in April, 1984, and analyzed for cadmium, copper, lead, nickel, zinc, chromium (heavy metals) and cyanide. Results of this sampling are provided in Table 2-11. The effluent loadings presented in the table were calculated using an average wastewater flow of 40 mgd.

TABLE 2-10
INFLUENT AND EFFLUENT
PRIORITY POLLUTANT MONITORING DATA
FOR THE GARY POTW

Pollutant	1981 Influent mg/l	1981 Effluent mg/l	1981 Effluent Loading(1) lbs/day
Metals			
Cadmium	0.02-0.03(2)	0.02-0.03	6.67
Chromium	0.12-0.21	<0.02-0.04	6.67
Copper	<0.05-0.05	<0.05-0.06	16.68
Lead	0.20	0.20	66.72
Mercury	<0.001-0.003	<0.001	0.33
Nickel	<0.1	<0.1	33.36
Silver	0.01-0.02	0.01-0.02	3.34
Zinc	0.22-0.30	0.06-0.20	20.02
Antimony	<2.5	<2.5	834.00
Arsenic	<0.01-0.01	<0.01	3.34
Beryllium	<0.05	<0.05	16.68
Selenium	<0.01-0.02	<0.01-0.01	3.34
Thallium	<0.02	<0.02	6.67
Volatiles			
Benzene	<0.005	<0.005	1.67
Toluene	<0.002	<0.002	0.67
All Others each	<0.001	<0.001	0.33
Acid Extractables			
Phenol	0.029-0.281	0.018-0.039	6.00
All Others each	<0.009	<0.009	3.00
Base-Neutral Extractables			
Naphthalene	0.096-0.108	<0.005	1.67
Acenaphthene	0.024-0.136	<0.005	1.67
All Others each	<0.005	<0.005	1.67

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(1) Assumes 40 mgd average flow.

(2) Two values reflect maximum and minimum concentrations for three composite samples collected over a three-day sampling period.

TABLE 2-11
HEAVY METAL AND CYANIDE INFLUENT AND EFFLUENT MONITORING DATA FOR THE HAMMOND POTW

Pollutant	1984 Influent mg/l	1984 Effluent mg/l	Effluent Loading(1) lbs/day
Cadmium	0.01-0.015(2)	0.006-0.011	2.00
Copper	0.228-0.256	0.051-0.058	17.01
Lead	0.1-0.60	0.118-0.267	39.36
Nickel	0.071-0.08	0.031-0.036	10.34
Zinc	0.611-3.85	0.266-0.336	88.74
Chromium	0.191-0.20	0.04-0.074	13.34
Cyanide	--	0.04	13.34

(1) Assumes 40 mgd average flow.

(2) Two values reflect maximum and minimum concentrations for three composite samples collected over a three-day sampling period.

2.3.3 Combined Sewer Overflows

Characteristics of combined sewer overflow (CSO) discharges to the Grand Calumet River system are summarized in Table 2-12. The map number codes in the left-most column refer to the CSO locations on Figure 2-6. Annual discharge volume estimates for the reported CSO points are listed, as billions of gallons per year, in Table 2-12.

If the annual overflow volume estimates for each outfall are grouped and summed according to Sanitary District boundaries, it is found that the CSO problem is distributed more-or-less equally (i.e.; roughly one third of the problem is attributed to each Sanitary District). In actuality, however, the impact on each subarea will depend more strongly on what pollutant loads are associated with each CSO and on CSO locations relative to areas of oxygen deficiencies and sediment accumulation.

Some examination of dissolved oxygen impacts of the various CSO discharges will be included in the waste load allocation study currently being conducted for the Indiana State Board of Health. This study will not consider the toxic and non-conventional pollutants discharged from CSO outfalls. However, preliminary determinations of CSO impacts on sediment contamination can be accomplished by correlating industrial discharger locations with those portions of the various collection systems wherein CSO problems originate. Table 2-13 summarizes geographic information on CSO discharge points relative to surficial sediment contamination levels. The industrial user data developed in the ongoing pretreatment programs for Gary, Hammond and East Chicago (see Section 3.3) should yield data necessary to better correlate CSOs and areas of contaminated sediments.

CSO outfalls in the GCR/IHC have been shown to be sources of contaminants adversely affecting near-shore water quality in southern Lake Michigan. Fecal coliform organisms, the principal analog parameter for sewerage pollution from CSOs, are short-lived in sunlight and die off in a matter of hours or days. Therefore, it is most probable that CSOs from the IHC and the lower half of the Grand Calumet River have the most direct, adverse impact on beaches along the southwest Lake Michigan coast.

TABLE 2-12

COMBINED SEWER OVERFLOWS TO THE GRAND CALUMET RIVER LOCATIONS AND CHARACTERISTICS

Map CSO Number	Mile-Segment(1) [Cross St.]	Sanitary District	Est. Annual Overflow Vol. [References below]
1	12.6-E.Br.	Gary	1.25 bg/year (USEPA, 1983)
2	12.3-E.Br. [Virginia St.]	Gary	0.59 bg/year (USEPA, 1983)
3	11.2-E.Br. [Hwy 90]	Gary	0.09 bg/year (USEPA, 1983)
4	11.0-E.Br. [Buchanan St.]	Gary	0.27 bg/year (USEPA, 1983)
5	10.0-E.Br. [Bridge St.]	Gary	0.43 bg/year (USEPA, 1983)
6	9.4-E.Br. [Hwy 90]	Gary	0.89 bg/year (USEPA, 1983)
7	7.6-E.Br.	Gary	0.75 bg/year (USEPA, 1983)
8	6.5-E.Br. [Cline Ave.]	E. Chicago	0.49 bg/year (USEPA, 1983)
9	4.7-E.Br. [Kennedy Ave.]	Hammond	1.80 bg/year (USEPA, 1983)
10(2)	4.6-W.Br. [Indianapolis Boulevard]	E. Chicago	2.93 bg/year (USEPA, 1983)
11	6.0-W.Br. [Columbia Ave.]	Hammond (pump sta.)	1.22 bg/year (USEPA, 1983)
12	6.0-W.Br. [Columbia Ave.]	Hammond	0.09 bg/year (USEPA, 1983)

TABLE 2-12 (Continued)

COMBINED SEWER OVERFLOWS TO THE GRAND CALUMET RIVER LOCATIONS AND CHARACTERISTICS

Map CSO Number	Mile-Segment[1] [Cross St.]	Sanitary District	Est. Annual Overflow Vol. [References below]
13	1.7-S.Ca. [Turning basin]	E. Chicago	0.23 bg/year (N/A)
14	1.7-S.Ca. [Opposite turning basin]	E. Chicago	(3)

---

[1] River miles, as delineated in ISHB 1984. Name of Segment or Reach: E.Br.= East Branch; W.Br.= West Branch; M.St.= Main Stem; S.CA.= Ship Canal, from Lake George Branch to Harbor.

[2] Assumed point of entry for Magoun Avenue Pumping Station CSO.

[3] Although listed as a CSO, this outfall is a storm sewer only. This outfall has been included because it discharges significant volumes of oily wastes which infiltrate into the storm sewer from contaminated groundwater and soils at the Energy Cooperative, Inc. site.

References: Williams, G.G. East Chicago Lab and Field data, Volume 3. Howard, Needles, Tammen, and Bergendoff, September 1981. As cited in Combined Sewer Overflow Loading Inventory for Great Lakes Basin, Final Report. March 1983. Prepared for USEPA Great Lakes National Progam Office, Chicago, by GCS Corporation.

Howard Needless Tammen and Bergendoff Company for Bessozzi, Carpenter, and Ignelzi, Inc. of Hammond, IN. East Chicago Combined Sewer Overflow Water Quality Impact Analysis. Volume I: Technical Report. January 1982.

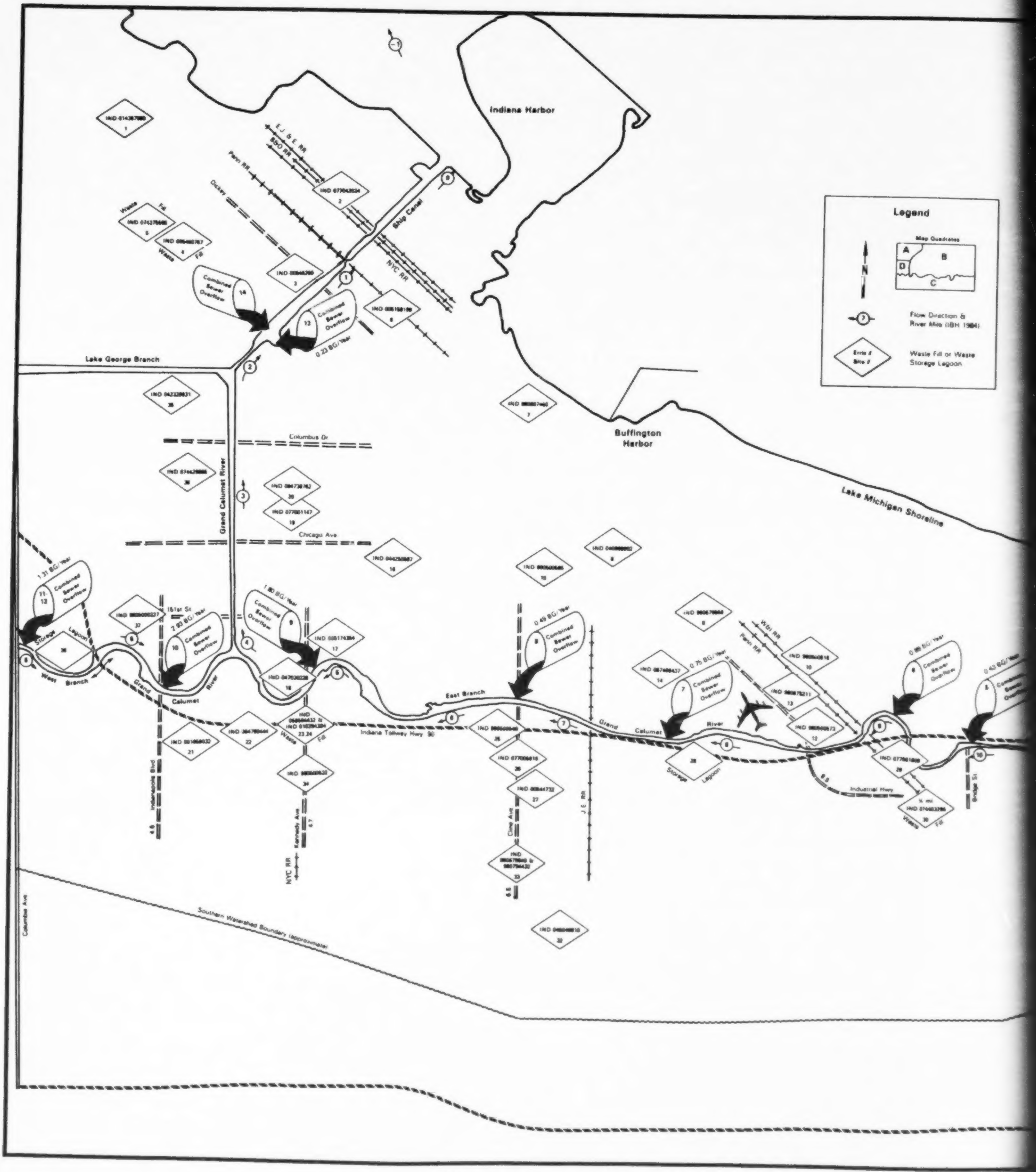
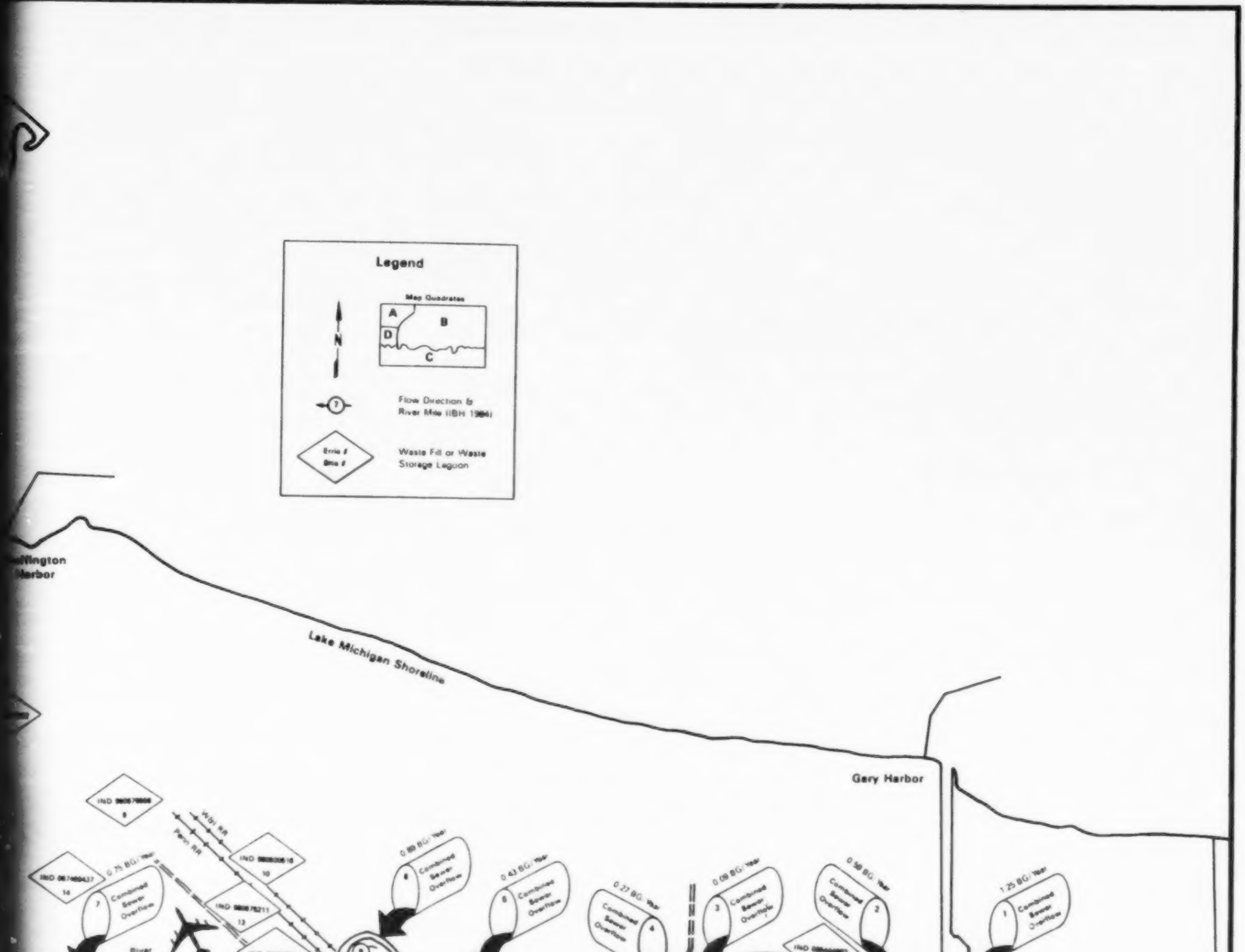

Indiana Harbor
Legend
Map Quadrates
A
B
C
D
N
Flow Direction & River Mile (IBH 1984)
Waste Fill or Waste Storage Lagoon
E.J. & E. RR
B&O RR
Penn RR
Dickey
Ship Canal
NYC RR
Waste Fill
Combined Sewer Overflow
14
13
0.23 BG/Year
Lake George Branch
Buffington Harbor
Columbus Dr
Grand Calumet River
Chicago Ave
Lake Michigan Shoreline
IND 042328831
35
IND 077001147
19
1.31 BG/Year
11-12
Storage Lagoon
West Branch
161st St
2.93 BG/Year
10
1.80 BG/Year
9
0.49 BG/Year
0.75 BG/Year
7
0.88 BG/Year
6
0.43 BG/Year
5
East Branch
Grand Calumet River
Indiana Tollway Hwy 90
Indianapolis Blvd
Kennedy Ave
NYC RR
Cline Ave
J.E. RR
Wabash RR
Penn RR
Industrial Hwy
½ mi
Bridge St
Columbia Ave
Southern Watershed Boundary (approximate)

Figure 2-6. Locations of CSO Discharges and Wastefill near t


Legend
Map Quadrates
A
B
C
D
N
Flow Direction & River Mile (IBH 1984)
Waste Fill or Waste Storage Lagoon
Buffington Harbor
Lake Michigan Shoreline
Gary Harbor
Calumet
River
Storage Lagoon
Waste Fill
Penn RR
Wbl RR
Industrial Hwy
Hwy 90
Bridge St
Buchanan St
Broadway St
Virginia St
12.4
8.8
Gary Municipal Boundary
0.75 BG/Year
0.89 BG/Year
0.43 BG/Year
0.27 BG/Year
0.09 BG/Year
0.58 BG/Year
1.25 BG/Year
Combined Sewer Overflow
7
6
5
4
3
2
1
8
9
10
11
12
13
14
IND
14
13
12
10
9
11
28
29
30
31

...ns of CSO Discharges and Wastefill near the GCR/IHC

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TABLE 2-13

COMBINED SEWER OVERFLOWS AND WASTEFILLS LOCATED NEAR HIGHLY CONTAMINATED SEGMENTS OF THE GRAND CALUMET RIVER BED

River Mile	River Segment(1)	Sediment Contaminant	Contaminant Level (mg/kg)	Potential Sources:	
				Wastefill #'s(2)	CSO #'s(3)
11.0	E. Br.	Cadmium	6.0	11B	1,2,3 & 4
10.0	E. Br.	PCB-1248	17.0	--	4 & 5
10.0	E. Br.	Phenol	1.66	—	4 & 5
10.0	E. Br.	Zinc	855.0	--	4 & 5
10.0	E. Br.	Chromium	1330.0	--	4 & 5
6.5	E. Br.	PCB-1248	10.1	12B & 28C [also mile 10.0]	7 & 8
6.5	E. Br.	Zinc	1025.0	12B & 28C [also mile 10.0]	7 & 8
6.9	W. Br.	Phenol	0.88	38D	11 & 12
6.9	W. Br.	Lead	644.0	38D [also mile 5.3, Hwy I-90 Bridge]	11 & 12
6.9	W. Br.	Mercury	1.48	38D	11 & 12
4.6	W. Br.	Copper	710.0	37D	10
4.6	W. Br.	Cadmium	18.0	37D	10
4.6	W. Br.	Silver	15.0	37D	10
4.6	W. Br.	Selenium	7.31	37D	10
4.6	W. Br.	Arsenic	36.7	37D	10
4.6	W. Br.	Cyanides	27.67	37D	10
4.6	W. Br.	Zinc	1465.0	37D [also mile pt. 5.3, Hwy I-90 Bridge]	10
4.6	W. Br.	Lead	854.0	37D [also mile 5.3]	10

TABLE 2-13 (Continued)

COMBINED SEWER OVERFLOWS AND WASTEFILLS LOCATED NEAR HIGHLY CONTAMINATED SEGMENTS OF THE GRAND CALUMET RIVER BED

River Mile	River Segment(1)	Sediment Contaminant	Contaminant Level (mg/kg)	Potential Sources: Wastefill #'s(2)	CSO #'s(3)
4.6	W. Br.	Nickel	670.0	37D	10
3.2	M. St.	Copper	94.0	36D [also mile 4.6]	—
3.2	M. St.	Mercury	2.44	36D	—
2.6	M. St.	Silver	19.0	36D [also mile 4.6]	—
2.0	Sh. C.	Cyanides	4.14	36D [also mile 4.6]	13
2.0	Sh. C.	PCB-1248	7.7	36D [also miles 10 & 6.5]	13
2.0	Sh. C.	Lead	654.0	36D [also mile 4.6]	13
2.0	Sh. C.	Chromium	740.0	36D [also mile 10.0]	13
2.0	Sh. C.	Mercury	0.72	36D [also mile 3.2]	13
2.0	Sh. C.	Mercury	0.73	3A [also mile 3.2]	14

(1)E. Br. = East Branch GCR
W. Br. = West Branch GCR
M. St. = Main Stem GCR
Sh. C. = Ship Canal

(2)Refer to Table 2-12

(3)Refer to Table 2-15

It is calculated that 57% of the CSO volume, on an annual basis, stems from discharge points downstream of river mile 8.0 (Cline Avenue). Impacts of CSO and other waste sources on Lake Michigan is currently under investigation in a study being performed for the Great Lakes National Program Office of the USEPA.

The East Chicago Sanitary District's pretreatment program document (see Section 3.3) provides information on industrial process wastewater sources which discharge to permitted combined sewer overflows. Using the District's 1983 industrial monitoring data, estimated dry weather toxic pollutant loadings from industrial discharges to the Alder CSO station (CSO Number 8 on Figure 2-6) were derived. These estimates are included in Table 2-14. During CSO events, all or a fraction of these industrial process wastewaters are discharged without treatment to the receiving stream and could result in significant toxic pollutant loadings, particularly for phenols and oil and grease.

Dry weather CSO discharges have been reported from outlets at Canal and 145th streets, in East Chicago. Because these discharges occur during periods of comparatively lower streamflow, the impacts of dry weather CSOs may be magnified.

2.3.4 Non-Point Sources

Non-point sources of contaminant input to the GCR/IHC include such diverse categories as highway runoff (including spills); surface runoff from industrial properties contiguous to the river; seepage of contaminated groundwater from dumps, landfills and waste lagoons; rain scour and dust fall; and illegal dumping.

Little is known about the extent of possible non-point contamination of the GCR/IHC. With the continued integration of various pollution control programs (i.e., RCRA, NPDES, CAA, CWA), the magnitude of many such sources may be declining. For example, with the implementation of industrial emissions controls under the Clean Air Act, significant reductions in rain scour and dustfall (as non-point pollutant sources) has occurred, especially during the 1970s.

TABLE 2-14

ESTIMATED TOXIC LOADINGS OF EAST CHICAGO INDUSTRIAL USERS TO ALDER COMBINED SEWER OVERFLOW STATION

(All values in lbs/month unless otherwise indicated)

INDUSTRY NAME	PHENOLS	LEAD	ZINC	COPPER	CADIUM	NICKEL	OIL&GREASE
AMERICAN RECOVERY	1104.89	4.93	13.03	1.89	0.18	0.85	13009.63
AMERICAN STEEL FOUNDRY	1.00	6.66	19.97	1.66	0.33	1.66	289.51
ARTIM TRANSPORTATION	.05	.18	0.22	.08	0.03	0.04	11.65
BESTWAY STEEL DELIVERY SERVICE	--	--	--	--	--	--	--
CALUMET LAUNDRY	--	--	--	--	--	--	--
GATX PLANT 1: #1 EUCLID	.03	.06	0.11	.02	0.00	0.01	1.83
GATX PLANT 1: #2 CARREY	.01	.10	0.16	.04	0.00	0.01	1.29
GATX PLANT 1: #3 143RD	.44	1.60	1.74	.044	0.07	0.36	68.57
INDIANA FORGE	.39	1.97	3.15	.49	0.10	0.49	77.06
INDIANA RADIATOR	.03	2.75	4.34	3.54	0.01	0.02	91.48
INLAND STEEL: #1 COKE PLT #2	11839.55	9.50	10.73	2.48	0.83	3.72	679.93
INLAND STEEL: #2 COKE PLT #2-1	17752.10	28.09	38.31	10.21	22.98	16.60	2046.80
INLAND STEEL: #3 COKE PLT #3	1738.44	4.44	9.36	1.81	0.49	1.31	1319.64
INLAND STEEL: #4 NORTH EXPAN	1.06	2.12	6.04	0.53	0.32	0.53	226.98
INLAND STEEL: #5 STL PLTS 3&4	327.68	33.73	96.38	8.03	12.85	9.64	2772.45
INLAND STEEL: RESEARCH CENTER	0.29	1.93	5.22	1.06	0.19	0.58	93.94
JONES & LAUGHLIN: #1 OLD SHT 9	2.34	7.42	7.42	1.95	0.78	2.34	208.04
JONES & LAUGHLIN: #2 TIN MLL 2	1.69	3.94	7.32	1.50	0.19	1.31	1666.14
JONES & LAUGHLIN: #3 OLD SHT N	0.22	1.39	2.86	0.44	0.07	0.51	31.63
JONES & LAUGHLIN: #4 TIN MLL 1	1.36	7.15	18.37	2.38	1.70	1.70	202.80
JONES & LAUGHLIN: #5 CKE-STL P	5.92	41.44	165.75	15.79	1.97	59.20	1844.98
LAIDLAW WASTE SYSTEMS	--	0.04	0.04	0.01	0.00	0.01	0.48
NAT. MATERIALS CORP. EAST	0.31	1.38	2.75	1.81	0.75	1.81	52.54
NAT. MATERIALS CORP. ALDER	--	--	--	--	--	--	--
NAT. MATERIALS CORP. BLOCK	--	--	--	--	--	--	--
NAT. MATERIALS CORP. PARISH	--	--	--	--	--	--	--
STANDARD FORGE	0.55	1.59	1.52	0.48	0.07	0.35	53.09
UNION CARBIDE ACETYLENE PLANT	0.16	0.12	0.38	0.10	0.01	0.05	2.82
UNION CARBIDE LINDE DIV.	1.30	2.89	14.00	0.87	0.14	0.72	72.00
UNION CARBIDE SPECIALTY GAS	1.82	2.02	2.42	0.71	0.20	0.50	57.32
US GYPSUM	0.45	2.97	2.38	0.74	0.15	1.04	184.08
TOTAL Lbs/Day	1092.74	5.68	14.48	1.97	1.48	3.52	835.64

Based on the numbers of industrial waste disposal sites in close proximity to the GCR/IHC, these sites were targeted as the priority category of non-point sources for further investigation. These sources are summarized in the following discussion, to the extent possible with the currently available database.

2.3.4.1 Waste Disposal Sites

At least 38 waste disposal/waste storage sites ("wastefills") are located within the planning area for this study, as depicted in Table 2-15. These 38 known sites are mapped on Figure 2-6. Based on the proximity of these sites to the river bank, and results of recent field investigations, eleven of the 38 mapped sites were selected for further investigation. These eleven are marked with asterisks in Table 2-15. The potential for chemicals in or at these sites to enter the Grand Calumet River is currently under investigation. Further study needs and potential regulatory actions are currently under consideration.

USEPA file data for the eleven sites marked with asterisks in Table 2-15 were reviewed. Because of the close proximity of these sites to the GCR (within 0.2 miles), these sites were initially chosen as presenting the greatest potential for contributing pollutants to the river.

Available information for the eleven sites in Table 2-15 is summarized below. This information was developed from review of ERRIS and NPL file data at USEPA, Region V.

Site 3A, Indiana Harbor Works, was used as a landfill and also for liquid waste groundwater injection by the Youngstown Steel Company and by its current owner, J&L Steel Company. Qualitative information indicates the presence of oily wastes and heavy metals in the landfill.

Site 11B, USSC Gary Works and Tubing Specialties, is used as a waste storage lagoon. No quantitative data on waste constituents currently are available for this site.

TABLE 2-15

WASTE FILL AND STORAGE LAGOON SITES MAPPED WITHIN THE GRAND CALUMET RIVER WATERSHED (USEPA 1984)

Site(1) No./Qd.	Indiana State ERRIS Number	Miles to River Bank	City	Owner or Name
1A	IND-014387880	2	Gary	Calumet Ind.
2A	IND-077042034	1/3	E. Chicago	Hodges Lloyd
* 3A	IND-005462601	<1/10	E. Chicago	Ind. Harbor Works
4A	IND-005460753	1	Hammond	American
5A	IND-074375585	1&1/4	Whiting	Amoco Wh. Refinery
6B	IND-005159199	2/5	E. Chicago	Inland Steel
7B	IND-980607469	1&1/2	E. Chicago	Cities' Ser. Refinery
8B	IND-040888992	1	Gary	Conservation Chemical
9B	IND-980679559	4/5	Gary	MIDCO II
10B	IND-980500516	3/5	Gary	Samacki Bros. Trucking
*11B	IND-005444062	<1/10	Gary	USSC Gary Wks. & Tubing Spec.
*12B	IND-980500573	<1/10	Gary	Site #75
13B	IND-980679211	2/5	Gary	Industrial Cinder, Inc.
14B	IND-067469437	1/3	Gary	Municipal Airport
15B	IND-980500565	1	Gary	Site #18
16B	IND-044250587	3/5	E. Chicago	Industrial Disposal Co.
*17B	IND-005174354	<1/10	E. Chicago	Du Pont Co.
*18B	IND-047030226	<1/10	E. Chicago	USS Lead Refinery
19B	IND-077001147	2/5	E. Chicago	Union Carbide
20B	IND-094738762	2/5	E. Chicago	Union Carbide

TABLE 2-15 (Continued)

WASTE FILL AND STORAGE LAGOON SITES MAPPED WITHIN THE GRAND CALUMET RIVER WATERSHED
(USEPA 1984)

Site(1) No./Qd.	Indiana State ERRIS Number	Miles to River Bank	City	Owner or Name
21C	IND-001859032	1/3	Hammond	Stauffer Chemical
22C	IND-094760444	1/5	Hammond	Shell Oil Terminal
23C	IND-068584432	3/10	Hammond	Ruan Transport Co.
24C	IND-010294304	3/10	Hammond	Chemical Haulers
25C	IND-980500540	1/4	Gary	Site #10
26C	IND-077005916	2/5	Gary	Gary Dev. Co.
27C	IND-005444732	1/2	Gary	Vulcan Materials
*28C	-------------	1/10	Gary	Sanitary Dist.
*29C	IND-077001808	<1/10	Gary	Sanitary Dist.
30C	IND-074403296	1/4	Gary Co.	Andersen Dev.
31C	IND-000606731	1&1/4	Gary	Mobile Chem. Phos. Div.
32C	IND-045046810	1&1/2	Gary	RJ Conner, Inc.
33C	IND-980679849 &-980794432	1&1/10	Gary	Ninth Ave. Dumps
34C	IND-980500532	1/2	Hammond	Old Hammond Dump
*35D	IND-042329631	1/10	E. Chicago	Mobile Oil Terminal
*36D	IND-074429895	1/5	E. Chicago	Gen. American Transp. Co.
*37D	IND-980500227	1/5	E. Chicago	Sanitary Dist.
*38D	-------------	<1/10	Hammond	Sanitary Dist.

---

(1) See Figure 2-6

* Sites within 1/5 mile of river

Site 12B, Number 75, is an uncontrolled waste fill with open access. No data on waste characteristics currently are available for this site.

Site 17B, DuPont Site, file not available for review.

Site 18B, USS Lead Refinery, is used for landfill or storage of plastic battery case shards (cleaned), smelting furnace slag disposal, and flue scrubber residual waste disposal. Lead and arsenic contamination at this site currently is under investigation by USEPA.

Site 28C, Gary Sludge Lagoon, is used for storage of municipal wastewater treatment plant sludge. No quantitative data on sludge characteristics currently are available.

Site 29C, Gary Sludge Lagoon located west of the WWTP and adjacent to the Grand Calumet River, is used for storage of municipal wastewater treatment plant sludge. This site currently is under investigation by the Indiana State Board of Health and USEPA for high PCB levels.

Site 35D, Mobil Oil Terminal, was used for disposal of tank bottoms, tank wastes and sludges from 1926 through 1974. Refinery wastes of unknown origin were disposed of in both a landfill and surface impoundment at this site. Refinery operations were discontinued in 1974; since that time, this site has been used for bulk storage of petroleum. No data are available regarding the quantity or types of wastes materials remaining on this site.

Site 36D, GATX Corporation, was until recently used as a waste storage lagoon. Both liquid and semi-solid wastes were present until removed between 1980 and 1983. No data are available regarding waste materials remaining at or near the site.

Site 37D, East Chicago Municipal Landfill, is a 50 acre site. No data are available regarding waste characteristics at this site.

Site 38D, Hammond Sludge Lagoon, is used for storage of municipal wastewater treatment plant sludge. Hammond Sanitary District presently is seeking a site for disposal of sludge from this lagoon.

Public review comments received after publication of the draft Master Plan report described additional wastefill sites. These sites are summarized in the following discussions:

U.S. Steel Landfill is reported to be comprised of several disposal areas on U.S. Steel Gary Works property. Land on both the north and south sides of the river is reportedly affected. At least two disposal areas are indicated. These areas include tracts of land authorized for Indiana Dunes National Lakeshore park acquisition. High levels of arsenic, chlorides, sodium and ammonia were reported in a 1983 report entitled Chemical and Biological Quality of Streams at the Indiana Dunes National Lakeshore, Indiana, 1978-80 (U.S. Geological Survey Water-Resources Investigations Report 83-4208). The U.S. Steel landfill is identified on the ERRIS listing as site #IND 005444062.

Four disposal areas, on the north side of the river, in Gary, were indicated to exist by a commentor. These areas are between river miles 14 and 10 and include the following:

- Stockton Dump (approximately river mile 10.5)
- Waste and Storage Lagoons (approximately river mile 11)
- Mason Basins (approximately river mile 12)
- East Dump (approximately river mile 13.5).

The Mason Basins reportedly receive blast furnace scrubber blowdown water containing ammonia, phenol, cyanide and heavy metals. Five of these basins are reported to be within 40 feet of the GCR and leach directly to the river.

Energy Cooperative, Inc. (ECI) is a bankrupt, 280-acre refinery on the IHC. An environmental investigation of the site, ordered by the bankruptcy court, indicated direct contamination of oil and other hydrocarbons to the Lake George Branch and the IHC as well as the East Chicago sanitary sewer.

On-site contaminant sources reportedly include drums containing catalyst, paint, oils and grease; PCB-containing transformers; storage tanks containing residual amounts of gasoline, fuel oil, caustic/phenolic mixtures, sulfide caustic and crude oil; process equipment containing residuals of P_2O_5, crude stills, H_2S, gasoline dyes and tetraethyl lead; miscellaneous containerized chemicals including acids, mercaptans, chlorine, caustics and cooling tower chemicals; and areas of contaminated soils. In addition, at least three on-site wastefills are alleged. The ECI landfill is identified on the ERRIS listing as site #IND082547803. This site is currently under investigation by the USEPA and the State.

Inland Steel Landfill is a large area of fill extending into Lake Michigan from the Inland Steel shoreline, forming a protective enclosure along the eastern edge of the Indiana Harbor mouth. Leachate from this extensive fill area is reported to escape directly to the Lake, or into the mouth of the IHC. The Inland Steel landfill is identified on the ERRIS listing as site #IND005159199.

These sites are being systematically reviewed for possible remedial action under CERCLA (Superfund) by the ISBH. Following this review, the State may propose individual sites for inclusion on the national Superfund list.

Based on information from Indiana, the potential number of wastefills in the GCR/IHC basin may be approximately double the number of confirmed sites considered in this report. The State is continuing to review and investigate these sites to determine their potential severity and candidacy for inclusion on the Superfund list.

CHAPTER 3. CONTROL PROGRAMS

This chapter presents the environmental/regulatory programs currently in effect to control pollutant discharges to the GCR/IHC. This discussion focuses on the major, known pollutant sources: municipal and industrial discharges. The existing control programs are largely implemented by the State; however, their programs are developed and operated on the basis of USEPA direction and are subject to periodic review by the Agency. The water quality control programs are developed and operated under the provisions and requirements of the Clean Water Act.

3.1 WATER QUALITY STANDARDS AND INDUSTRIAL EFFLUENT GUIDELINES PROGRAMS

This section includes a presentation of the current USEPA guidelines and requirements (under the authority of the Clean Water Act) for the establishment of water quality criteria and standards. A discussion of the existing Indiana water quality control program for the GCR/IHC is also included. Although the USEPA has delegated the authority to establish such programs to the State, the Agency reserves the right to review these programs for consistency with USEPA guidelines and statutory requirements. A discussion of the statutory basis for water quality programs development is provided, followed by a comparison of Indiana's program with USEPA guidance and requirements.

3.1.1 Introduction

The Clean Water Act (CWA) is the statutory basis for the comprehensive national strategy to restore and maintain the physical, biological and chemical integrity of U.S. waters. The Act focuses on controlling the sources of those pollutants determined to be most deleterious to receiving waters. Regulated pollutants include conventional pollutants, such as BOD and suspended solids; nonconventional pollutants, such as iron and ammonia; and toxic pollutants, such as heavy metals and toxic organic compounds. Sources of water pollution subject to regulatory control include point sources and nonpoint sources, dredge or fill material discharges, discharges from vessels, and spills.

Point source pollutant discharges are controlled through a permit system authorized in Section 402 of the CWA. National Pollutant Discharge Elimination System (NPDES) permits are issued to individual point sources by USEPA Regional Offices or by 36 USEPA-approved State authorities. Limits for pollutant reduction contained in NPDES permits are binding obligations that must be met for continued discharge. Initial reliance is placed on technology-based standards for direct and indirect point source discharges. Ambient water quality-based standards are used to protect the integrity of the nation's waters where technology-based standards are insufficient to achieve water quality standards.

3.1.2 Technology-based Standards

Technology-based standards that reduce the regulated pollutant load in the discharges of regulated industries are called effluent standards. Effluent standards are nationally uniform discharge limitations developed and promulgated by the USEPA. Technology-based standards for industrial point sources are targeted toward regulated pollutants (including conventional, nonconventional and toxic pollutants), and on the industrial categories that contribute the majority of these pollutants. Certain industrial categories which are subject to technology-based standards are referred to as "primary industries." Primary industries are specified in the settlement agreement reached in National Resources Defense Council v. Train, 8 ERC 2120 (D.D.C. 1976), modified 12 ERC 1833 (D.D.C. 1979), and are deemed to be the major contributors of toxic pollutants.

Under the 1976 settlement agreement, USEPA was to promulgate technology-based standards to be attained by 21 specific industrial categories (primary industries), for 65 toxic chemicals and classes of chemicals. The 65 chemicals and classes of chemicals were subdivided into 129 (now 126) distinct substances commonly known as priority pollutants. The 1979 modification of the settlement agreement expanded the list of primary industries from 21 to 34 categories.

To date, technology-based standards are promulgated for 13 industrial categories and proposed for an additional 9 categories. The remaining 12 industrial categories are now excluded from regulation under paragraph eight of the settlement agreement. Paragraph eight allows the Administrator to exclude industrial categories from regulation, under certain conditions, and after appropriate studies have been conducted. Regulated industrial categories not specified in the settlement agreement are referred to as "secondary industries." At present, technology-based standards exist for 15 secondary industries.

The CWA required industries to meet interim standards based on best practicable control technology currently available (BPT) by July 1, 1977. The next level of industrial effluent limitations, to be attained by July 1, 1984, is best available technology economically achievable (BAT), established primarily for control of toxic pollutants, and best conventional pollutant control technology (BCT), for maximum control of conventional pollutants. In addition to the BPT, BAT and BCT regulations for existing sources, the CWA also established new source performance standards (NSPS) for new industrial discharges. Effluent guidelines for the steel industry (BPT, BAT, BCT), the major discharger to the Grand Calumet River, have been in place since 1982.

Indirect industrial dischargers (i.e., regulated industries that discharge wastewater to municipal sewage treatment plants) must comply with pretreatment standards for existing sources or pretreatment standards for new sources. These pretreatment standards, combined with pollutant removals achieved by municipal treatment plants, result in an approximate equality between direct and indirect industrial discharges with regard to regulated pollutants and ultimate pollution reduction.

3.1.3 Water Quality Based Standards

In situations where water quality objectives are not being met, water quality-based standards are employed to supplement technology-based controls. The need for water quality-based standards is evaluated within the framework of the water quality management process. States have the lead role in initiating the water quality management process, as established under Section 303 of the CWA. Each State is required to review its existing Water Quality Standards at least every three years, revise them when appropriate, and submit such revisions to EPA for approval. If EPA determines that the revised standards meet the requirements of the CWA, it approves the standards. EPA must propose and promulgate its own standards under Section 303(C)(3)(A) where it finds State revision inadequate.

Water Quality Standards for a particular stream segment consist of two basic elements: a designated use (or multi-use) such as recreation, protection and propagation of fish, agricultural and industrial uses or public water supply; and criteria for ambient concentrations of various pollutants, to protect the designated use. Use designations are to be consistent with the goals of Sections 101(a)(2) and 303(c)(2) of the Act. If a state designates or has designated uses that do not include those specified in Section 101(a)(2), of the Act (i.e., uses other than for the protection and propagation of fish, shellfish and wildlife and "...for reaction in and on the water") the state must conduct and submit to EPA a use attainability analysis.

A use attainability analysis is also required when a state wishes to remove a designated use specified in Section 101(a)(2) or to adopt subcategories of uses specified in Section 101(a)(2) (e.g., limited protection and propagation of aquatic life) that require less stringent criteria than are currently adopted. Guidance for conducting use attainability analyses was published on November 1983, by the EPA Criteria and Standards Division, of the Office of Water Regulations and Standards (Technical Support manual entitled "Waterbody Surveys and Assessments for Conducting Use Attainability Analyses).

States must adopt water quality criteria to protect the designated use of a given water body. The criteria adopted must provide sufficient parametric coverage and be adequately stringent to protect the designated use. USEPA development of ambient water quality criteria (as required by Section 304(a)(1) of the CWA) has occurred through a series of key publications:

- 1968 "Green Book": contains general narratives and a range of possible water uses and concentrations necessary to support the use.
- 1973 "Blue Book": presents criteria in a numerical format based on limited data. The use of an application factor is introduced.

- 1976 "Red Book": derives criteria from an expanded data base.
- 1980 Guidelines for Deriving National Water Quality Criteria: Two number criteria are developed for each pollutant-maximum permissible and 24-hour average values. Criteria are based on a minimum acceptable data base. Publication of Ambient Water Quality Criteria Documents.
- 1984 Guidelines for Deriving Numerical National Water Quality Criteria: Latest revision replaces the previous 24-hour maximum exposure limits with a 30-day average value. An allowance for one episode of excursion over the average is also presented for a period not to exceed 96 hours in any 30 consecutive days. Criteria are based upon an expanded minimum data base and methods of statistical analysis less subject to bias and anomalous behavior. Metal criteria are expressed as active metal rather than total metal.

To date, National Ambient Water Quality Criteria have been published for 65 toxic substances (Section 307(a)(1) priority pollutants). Criteria for dissolved oxygen, ammonia, chlorine and 2,3,7,8-TCDD (Dioxin), and revised criteria for arsenic, cadmium, chromium, copper, cyanide, lead and mercury were published in 1984. These criteria are of two basic kinds: concentrations estimated to be protective of aquatic life and wildlife; and concentrations relevant to the protection of human health. These concentrations are derived according to the procedures in the Guidelines issued in 45 FR 79318 (November 28, 1980) and revised Guidelines summarized in 49 FR 4551 (February 7, 1984). These criteria are best estimates of the concentration-effect relative informed scientists are able to make, based on information from published studies. Specific, numerical, concentration limitations are established for most pollutants.

A State may adopt these USEPA-recommended criteria in support of State standard setting. However, these are laboratory-derived values and may not adequately reflect a local condition. Therefore, the Agency has also published guidance, recently updated and revised, to assist States in deriving site-specific criteria which consider sensitive resident species and receiving stream conditions, and whole effluent toxicity bioassay techniques where pollutant-specific analyses may be impractical or inappropriate.

3.1.4 Water Quality Standards Review and Revision Process

In November 1983, EPA published a new water quality standards regulation (40 CFR 131) in order to update and revise the water quality standards process. The regulation outlines the procedures for developing, reviewing, revising, and approving State water quality standards. States are not required to use a single method for their standard-setting process. Instead, States are encouraged to choose new or different methods if they are appropriate. Methods for updating water quality standards are explained in the Water Quality Standards Handbook, also published in November.

USEPA is responsible for reviewing State water quality standards and the overall water quality management process to ensure consistency with the CWA. States are required to submit the results of their Water Quality Standards reviews to the appropriate Regional EPA Offices. Pursuant to 40 CFR 131.6, States must submit, at a minimum, the following elements:

(a) Use designations consistent with the provisions of Sections 101(a)(2) and 303(c)(2) of the Act.

(b) Methods used and analyses conducted to support water quality standards revisions.

(c) Water quality criteria sufficient to protect the designated uses.

(d) An anti-degradation policy consistent with §131.12.

(e) Certification by the State Attorney General or other appropriate legal authority within the State that the water quality standards were duly adopted pursuant to State law.

(f) General information that will aid the Agency in determining the adequacy of the scientific basis of the standards that do not include the uses specified in Section 101(a)(2) of the Act, as well as information on general policies applicable to State standards that may affect their application and implementation.

USEPA will review each aspect to ensure that analyses and methods are sound and that resulting standards are consistent with CWA objectives. As mentioned above, a key element of EPA's review will be devoted to evaluating State anti-degradation policies, which are specified plans that evidence State efforts to maintain existing stream uses and prevent the deterioration of pristine waters.

The Water Quality Standard Process described in the preceding discussion is tied to many other USEPA programs and must interface properly to be successful. States may receive grants for water quality planning and management under §106 and 205 of the Act. The Continuing Planning Process is meant to integrate the State's planning, construction grants, and enforcement activities into a coordinated strategy to meet the water quality goals of the Act.

The water quality standards process is also linked to the §201 Construction Grants Program in that, after 1984, grants may be awarded to POTWs only in areas where standards have been reviewed. Also, proposals for construction of advanced treatment plants must be justified in terms of the water quality of the affected stream segment.

NPDES permits are also part of (actually the result of) the water quality standards process. Not only can water quality standards be translated into permit limits, permit conditions can be used to collect data on a stream segment to improve the standard-setting process. Alternatively, narrative water quality standards can serve as the basis for toxicity-based permits.

3.1.5 Indiana Water Quality Standards Program for the Grand Calumet River and Indiana Harbor Ship Canal

State water quality standards for the GCR/IHC were first promulgated in 1969. At time of promulgation, separate sets of standards existed for the River and Canal, with control points established for monitoring. Combined GCR/IHC standards were first issued in 1973. When established, these standards were considered advanced, based on prevailing custom at the time. The 1973 standards were subsequently revised in 1978. Although no further revisions or updates have since occurred, these are anticipated following completion of the current wasteload allocation process.

At the time the 1978 standards were issued, the "Red Book" was the current guidance available from EPA on ambient water quality criteria. The "presumptive applicability" of these criteria had been established by legislation, requiring water quality standards to be at least as restrictive as the Red Book criteria. Criteria were not yet available for CWA Section 307(a)(1) priority pollutants, however. Guidance on deriving site-specific water quality criteria had not been developed. Finally, the requirement (and methods) to conduct use attainability analyses had not yet been established.

3.1.5.1 Designated Use of the Grand Calumet River and Indiana Harbor Canal

In 1978, the Indiana Stream Pollution Control Board (SPCB) classified the Grand Calumet River and Indiana Harbor Canal "for partial body contact, limited aquatic life and industrial water supply". The SPCB cited the following as reasons for this classification.

- The Grand Calumet River and Indiana Harbor Canal are predominantly comprised of treated wastewaters and wastewaters of nonpoint source origin
- Historically, the major function of these streams has been the conveyance of waters of such character and quality
- The stream beds are of "unnatural character"
- The streams may not be capable at all times of sustaining a well-balanced fish community even if all discharged wastewaters were treated to the highest degree technologically and economically feasible.

The use classification adopted by the SPCB allows the State to set water quality standards less stringent than those established for recreational use waterways. However, Lake Michigan, Indiana Harbor, and the Illinois River have their own water quality standards. Consequently, effluent limitations set on the GCR/IHC system must be adequate to assure compliance with the standards of these downstream waterways.

3.1.5.2 Indiana State Antidegradation Policy

The State adopted an antidegradation policy in May 1978. Specifically, the policy requires:

- Maintaining existing instream beneficial uses (i.e., limited aquatic life and partial body contact)

- Maintaining waters whose existing quality exceeds that of established standards.

The SPCB may allow "limited degradation" of such waters, however, if it is "affirmatively demonstrated" to be "justifiable on the basis of...economic or social factors and will not interfere with or become injurious to any beneficial uses made of, or presently possible, in such waters".

3.1.5.3 Indiana Water Quality Standards for Protection of the Grand Calumet River and Indiana Harbor Canal

Numerical standards were promulgated by the State in May, 1978, for the following parameters: pH, DO, temperature, fecal coliform, filterable residue, total ammonia, total phosphorus, chlorides, sulfates, cyanide, fluoride, dissolved iron, total mercury, phenol, and PCB. Narrative standards were established for oil and grease, toxic substances, persistent or bioconcentrating substances, and miscellaneous trace contaminants and radionuclides.

The 1978 water quality standards focused primarily on limits for conventional pollutants. As was true for most State programs of that era, the Indiana standards did not specifically include many of the contaminants listed in the "Red Book", much less for the Section 307(a)(1) priority pollutants. As the May 1978 revision is the current edition of the State standards, the SPCB has not incorporated the currently available guidelines and data on ambient water quality criteria, as specified in 45 FR 7931 (November 1980) and 49 FR 4551 (February 7, 1984).

3.1.6 Comparison of Indiana Water Quality Standards Program for the GCR/IHC With Current USEPA Guidance and Regulations

Designated Use

The use designation established by the State of Indiana for the Grand Calumet River and Indiana Harbor Canal does not fully include those uses specified in Section 101(a)(2) of the CWA (i.e., "fishable, swimmable"). Although the GCR/IHC may not currently be capable of meeting the full fishable/swimmable goals of the Act, the State is nevertheless required (under Section 131.10 of the CWA) to conduct a use attainability analysis to determine the uses which are appropriate and which can be maintained. Guidance for conducting this evaluation is provided in the USEPA publication: Water Body Survey and Assessment Guidance for Conducting Use Attainability Analysis (USEPA 1983b).

In conducting a use attainability analysis for the GCR/IHC, the State must determine: (1) what are the aquatic use(s) currently being achieved; (2) what are the potential uses that can be attained based on the physical, chemical and biological characteristics of the water body; and (3) what are the causes of impairment of these uses. The critical element of this evaluation is determining the potential of the aquatic system(s) in the absence of human-caused sources of pollution.

States may establish subcategories of a use specified in Section 101(a)(1), only if the State can demonstrate (through use attainability analysis) that attaining the designated use is not feasible because:

- Naturally occurring pollutant concentrations prevent the attainment of the uses; or
- Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges (without violating State water conservation requirements) to enable uses to be met; or
- Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
- Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
- Physical conditions related to the natural features of the water body, such as the lack of proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
- Controls more stringent than those required by Sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

Section 131.10(b) of the CWA specifies that in designating water body uses and the corresponding criteria for protection of said uses, the State must consider the designated uses and water quality standards of downstream waters. Adopted standards for the water body under consideration must provide for attainment and maintenance of the duly established water quality standards of downstream waters. Although certain of the existing standards were promulgated to protect Lake Michigan (e.g., phosphorus), the existing Indiana water quality standards do not fully consider potential impacts on the Lake or the Illinois River. However, the impacts on Lake Michigan are being considered in the WLA modeling study currently being performed by the State. Additionally, the ISBH has begun an initiative toward revising water quality standards, based on the information developed in the WLA study.

Finally, the Marquette Park lagoons, located at the headwaters of the GCR, are not separated from the GCR with respect to standards, yet represent an area of higher biological integrity and reduced levels of contaminants. It may therefore be appropriate to consider a higher designated use for this area than would be appropriate for the downstream areas of the GCR/IHC.

Antidegradation Policy

Section 131.6(d) of the CWA specifies that the State adopt an antidegradation policy consistent with Section 131.12. Pursuant to the latter Section, the State must identify methods for implementing the antidegradation policy such that existing instream uses are maintained and protected. No methods have yet been developed or specified by the State for maintaining and protecting the designated uses ("limited aquatic life or partial body contact"). The CWA requires that levels of water quality be specifically linked to designated uses.

Water Quality Standards Revision

The CWA requires that each State review its promulgated water quality standards at least once every three years and either revise or adopt standards protective of the aquatic systems under examination. The last revision of the Indiana State water quality standards occurred more than six years ago.

Section 131.11 of the CWA specifies that States must adopt water quality criteria protective of designated uses. Such criteria are to be based on sound scientific rationale. The last revision to the State water quality standards for the GCR/IHC occurred in 1978. Subsequent to that time, the USEPA published new guidelines for deriving water quality criteria, in November 1980 (45 FR 79318). These guidelines were later revised, in February 1984 (49 FR 4551). Ambient water quality criteria were published for 65 Section 307(a)(1) priority pollutants as well as for ammonia, chlorine, and DO. The 1978 water quality standards issued by the State of Indiana do not as yet reflect this information.

The existing water quality standards for the Grand Calumet River and Indiana Harbor Canal are only partially linked to the protection of the designated uses for these waters. In particular, standards for toxic contaminants have not yet been sufficiently developed to protect the uses "limited aquatic life and partial body contact". The CWA specifies that pollutant-specific numerical criteria, narrative criteria, or a combination of the two be adopted.

Pollutant-specific criteria are commonly used when the control of specific contaminants is a major concern. Narrative criteria may be adopted in lieu of numerical criteria as the basis for setting standards for the control of toxic pollutants. Section 131.11(2) of the CWA specifies, however, that the State must then provide to EPA information identifying the methods by which the State intends to regulate point source discharges of toxic contaminants on water quality limited segments, based on narrative criteria.

The State of Indiana has adopted narrative criteria for toxic as well as persistent or bioconcentrating substances. No methods have yet been established by the State, however, for regulating discharge of these substances based on the narrative criteria (e.g; biological monitoring of effluents such that a particular tolerance or LC_{50} value is not exceeded). Further, no guidelines have yet been adopted by the State on time, place, method and duration of sampling, or on the statistical requirements of data collection and analysis.

3.2 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Information presented in this section summarizes the pollutant characteristics and discharge limitations for the municipal and principle industrial point source discharges to the GCR/IHC, as relates to the NPDES program. Additional information describing these sources is prescribed in Section 2.3 of this report. Locations of these point sources are depicted in Figure 2-5.

The requirements of the CWA for pollutant reduction by point source dischargers are implemented through a permit system authorized in Section 402. National Pollutant Discharge Elimination System (NPDES) permits are issued to individual point sources by EPA Regional Offices or by 36 EPA-approved State authorities. Pollutant discharge limits contained in NPDES permits are obligations that must be met by the permittee for continued discharge.

Each NPDES permit has a set lifespan, from several months to a maximum of five years. The time period may be affected by new regulations, new waste handling facilities or new industrial processes contributing to the effluent. The permit may also be amended during its lifespan as a result of the above actions. It is the responsibility of the discharger to apply for extension or renewal of the permit prior to its expiration, or in the event of major changes in treatment processes or wastestream characteristics. Should a permit expire during the issuance period, provisions of the old permit remain in effect.

3.2.1 Industrial Point Sources

There are seven major industries currently discharging to the GCR/IHC system, including:

- Citgo Petroleum Corporation
- E.I. du Pont de Nemours and Co.
- Inland Steel Corporation
- Jones Laughlin Steel
- U.S.S. Lead Refinery, Inc.
- U.S. Steel Corporation
- Vulcan Materials Company.

A brief description of the NPDES permit discharge limitations and the permit compliance status for each of these facilities is provided below. This information is summarized in Table 3-1.

Citgo Petroleum Corporation

The latest permit for the Citgo Petroleum facility became effective on December 14, 1981 and is scheduled to expire on November 30, 1986. Effluent limitations, which are based on Indiana Water Quality Standards, control oil and grease and pH. During the third quarter of 1984, the company was in compliance with permit limitations.

E. I. du Pont de Nemours and Company

The most recent NPDES permit for the du Pont facility became effective on January 1, 1979 and expired on June 30, 1981. Effluent limitations in the expired permit were based on Indiana Water Quality Standards and Grand Calumet River waste load allocations. Limitations were included on oil and grease, pH, BOD, suspended solids, dissolved solids, chlorides, sulfates, phosphorus, and ammonia. A briefing memo accompanying the permit indicated that the company utilized herbicides and fungicides and that the handling and disposal of these items were analyzed in a toxics review submitted to the State of Indiana. During the third quarter of 1984, the company was in compliance with its permit conditions.

Inland Steel Corporaton

The current Inland Steel NPDES permit became effective on March 6, 1984 and expires in February, 1989. The permit regulates 13 separate outfalls to the GCR/IHC. Effluent limitations are based on Federal guidelines for Iron and Steel Manufacturing Point Source Categories and water quality standards for the Indiana Harbor Ship Canal, Grand Calumet River and Lake Michigan. Pollutants regulated by the permit vary from outfall to outfall, due to the different wastewaters discharged. The permit limits the discharge of suspended solids, oil and grease, pH, lead, zinc, cyanide, phenols, ammonia, BOD, and fecal coliforms. The permit also requires monitoring at several outfalls for chromium, copper, nickel, zinc, lead, chlorine residual, chloride, sulfate

TABLE 3-1

NPDES PERMIT HISTORY OF MAJOR INDUSTRIAL DISCHARGERS

Industry	NPDES Permit History	Compliance During Third Quarter 1984
Citgo Petroleum Corporation	12/14/81 Issued 5/30/83 Amended 11/30/86 Expires	Compliance
E.I. DuPont de Nemours and Company	1/1/79 Issued 6/30/81 Expired	Compliance
Inland Steel Corporation	3/6/84 Issued 2/28/89 Expires	Compliance
Jones and Laughlin Steel	10/31/79 Expired 2/27/81 Reissued 6/30/81 Expired 7/25/84 Public Notice[1]	Compliance
U.S.S. Lead Refinery, Inc.	6/15/75 Issued 3/31/80 Expired 5/24/84 Prehearing Conference	Noncompliance with total lead[2]
United States Steel Corporation	6/1/83 Issued 5/31/88 Expires	Compliance[3]
Vulcan Materials Company	8/5/81 Issued 7/31/86 Expires	Compliance

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[1] Public notice of intent to reissue permit has been issued.

[2] Based on fourth quarter State and USEPA monitoring data.

[3] Daily average zinc levels exceeded permit limits in September, 1984.

and fluoride. Additionally, the permit requires several unique study programs and subsequent construction to reduce process wastewater contamination of non-contact cooling waters, increase recycled water usage, and reduce priority pollutant discharges. This work is expected to be completed July 1, 1987. During the third quarter of 1984, Inland Steel was in compliance with its permit conditions.

Jones and Laughlin Steel Company

The Jones and Laughlin (J&L) NPDES permit became effective on October 31, 1978, was reissued on February 27, 1981, and expired on June 30, 1981. Public notice of the intent to issue a new permit to J&L was posted on July 25, 1984. Permit effluent limitations exists for ammonia, phenol, cyanide, chlorides, sulfates, fluorides, oil and grease, pH, suspended solids, tin, zinc, chromium, and temperature. These limitations are based on Indiana Water Quality Standards and the wasteload allocation study for the GCR/IHC. When issued, the new NPDES permit will also contain lead discharge limitations, will require monitoring for organic pollutants, and will require implementation of a Best Management Practices plan for reducing cooling water contaminants. During the third quarter of 1984, the plant was in compliance with existing permit conditions.

U. S. S. Lead Refinery

The United States Steel Lead Refinery permit became effective on June 10, 1975 and expired on March 31, 1980. Public notice of the intent to issue a new permit was posted on August 15, 1984. The current NPDES permit limits discharges of total lead, arsenic, sulfate, fluoride, pH, and suspended solids. The company was reported as being in compliance during the third quarter but was found to be significantly out of compliance with total lead limits in State and USEPA effluent monitoring.

U. S. Steel Corporation

The present NPDES permit for U. S. Steel became effective on June 1, 1983 and expires on May 31, 1988. The permit regulates 20 separate outfalls to the GCR/IHC. The effluent limitations are based on Federal guidelines for the

Iron and Steel Manufacturing Point Source Category, Indiana Water Quality Standards for the GCR, and a Consent Decree issued September 27, 1977 (as modified July 10, 1980).

Effluent limitations at each outfall vary according to the type of waters discharged. Depending on the particular outfall, the permit controls pH, ammonia, cyanides, phenols, oil and grease, zinc, lead, total residual chlorine and chromium. At several outfalls, monitoring is required only for sulfates, fluorides, mercury, iron, and water temperature. The permit also includes two special conditions. The first is a characterization and monitoring study designed to minimize the discharge of coke making and iron making wastewater pollutants. The second condition is an organic pollutant monitoring study designed to determine the presence and quantity of certain toxic organic pollutants in process wastewaters. Depending on the results of these studies, the permitted effluent limitations could be revised. During the third quarter of 1984, U. S. Steel was reported as being in compliance with its permit conditions, although daily average zinc levels exceeded the permitted limits in September, 1984.

Vulcan Materials Company

According to EPA Region V records, Vulcan Materials is subject to two permits. One permit, which regulates the facility's major discharge, was not available for review. The other NPDES permit was issued on August 5, 1981 and authorizes the facility to discharge to the Grand Calumet River until July 31, 1986. This permit regulates a discharge consisting of noncontact cooling water, boiler blowdown, stormwater runoff and softener regeneration. The permit contains limitations for oil and grease, TSS, BOD, chlorides, tin, pH and temperature.

During the third quarter of 1984, the facility was in compliance with its permit conditions.

Minor Industrial Dischargers

Minor industrial dischargers to the Grand Calumet include: American Steel Foundries, Blaw Knox Foundry, Industrial Disposal and Explorer Pipeline

Company. Discharges from each of these facilities are subject to the limitations of current NPDES permits.

3.2.2 Municipal Point Sources

Like the industrial dischargers, municipal treatment works operate under NPDES permits that establish the plant's effluent limitations as well as monitoring, reporting and operating requirements. Brief NDPES permit histories, permit discharge limitations and compliance status for the three POTWs are provided below.

East Chicago

The latest NPDES permit was issued on October 15, 1977, and contained limitations for the discharge of ammonia, BOD, chlorides, fluoride, cyanide, oil and grease, phenol, phosphorus, suspended solids, pH and sulfate. The following permit-related activities have occurred since 1977:

- October 3, 1978 - a compliance schedule for pretreatment program development was amended to the permit. The cover letter attached to this amendment cited a concern for heavy metals content in the sludge from the plant.
- August 31, 1981 - the plant was allowed to change from year-round disinfection to seasonal disinfection as a result of revisions to Indiana wastewater treatment guidelines.
- May 31, 1982 - the 1977 NPDES permit expired.
- February 2, 1982 - a court order was issued in U. S. District Court which required the East Chicago Sanitary District to improve operation and maintenance at all facilities, install additional solids and sludge handling equipment, enlarge the sludge lagoon, and develop a sludge disposal plan.

The East Chicago Sanitary District has experienced chronic violations of its NPDES permit discharge limits and has been slow in completing the treatment system modifications necesary to achieve consistent compliance. Because of unreasonable delays in correcting effluent control problems (a Facilities Plan has yet to be developed, despite nearly a decade of Federal grant support), USEPA has sought legal recourse to protect water quality in the GCR/IHC. The Agency issued an Administrative Order in October, 1980, regarding serious operation and maintenance problems and permit violations. This order imposed a ban on additional sewer connections and required a number of improvements to the plant. In November, 1981, the State of Illinois filed suit against the East Chicago Sanitary District in the Federal Court of the Northern District of Indiana. The USEPA joined the suit as a co-plaintiff on January, 1982.

A court order was also signed by the Magistrate of the U. S. District Court in February, 1982. This order required 34 detailed steps to be undertaken to ensure adequate operation and maintenance of the treatment works, to provide as much removal of pollutants as possible without major plant expension and to eliminate unpermitted combined sewer and dry weather overflows.

East Chicago POTW effluent quality has improved significantly, and all major treatment units are in operation. However, the plant is still unable to consistently meet the NPDES permit requirements. Negotiations toward development of a comprehensive pollutant abatement schedule are continuing, to include pretreatment, sludge handling, construction planning and sewer cleaning.

During September, 1984, the East Chicago facility was in non-compliance with NPDES permit discharge limitations for ammonia, phenol, cyanide, fluorides, chlorides, sulfates, oil and grease, BOD and total suspended solids.

Gary

The latest NPDES permit for the Gary POTW was issued on July 1, 1977 and contained limits for flow rate, BOD, suspended solids, fecal coliform, phosphorus, phenol, cyanide, fluoride, chloride, sulfate, ammonia, oil and grease and pH. On April 4, 1979, Gary was required to develop a pretreatment program as part of the NPDES permit. The 1977 NPDES permit expired on April 30, 1982.

On June 15, 1983, a Consent Judgment was issued in U. S. District Court against the City of Gary. The Judgment included requirements for increased staffing and training, restoration of existing equipment, construction of additional secondary treatment and sludge handling facilities, construction of advanced wastewater treatment facilities, improved operating and maintenance procedures, new effluent limitations, and compliance with pretreatment regulations.

The Gary Sanitary District has experienced chronic problems in complying with effluent standards and has been frequently cited by EPA for non-compliance. Major actions include a 1976 Administrative Order for effluent violations; a 1978 Federal lawsuit for failure to comply with NPDES discharge permit conditions; a 1978 injunction to prevent raw sewage bypassing to the Grand Calumet River; and a 1983 Consent Judgment requiring proper operation and maintenance of the plant. Earlier compliance problems resulted from old or inadequate treatment facilities, but the majority of these problems have been corrected (with the assistance of Federal grants). Current compliance problems are occurring as a result of improper or inadequate operation and maintenance of the facilities. Rapid deterioration of new equipment and lack of a replacement fund have jeopardized the Federal investments in the treatment works.

During September, 1984, the Gary POTW was in non-compliance with the NPDES permit for violation of ammonia limits. A notice of violation will be issued for this occurrence. USEPA is pursuing an enforcement action in Federal court for violation of the Consent Judgment; a decision is pending in Federal court.

Hammond

The most recent NPDES permit for Hammond became effective on January 8, 1979. The permit included limitations on flow rate, BOD, suspended solids, phosphorus, phenol, cyanide, chloride, sulfate, fluoride, fecal coliforms, pH and oil and grease. The permit indicated that the maximum discharge loadings for BOD, phosphorus and ammonia would be reduced upon completion of additional treatment works construction (which was anticipated by July 1, 1983). The permit also required Hammond to develop a pretreatment program. The NPDES permit expired on June 30, 1983.

The Hammond Sanitary District has experienced problems in meeting permit conditions. These problems have concerned combined sewer overflow discharges of fecal material, fats, and oils and grease to Lake Michigan, and overfilling of sludge lagoons proximal to the Calumet River. In 1980, the USEPA filed a civil action to prevent the CSO related contamination of Lake Michigan. Two orders resulted from this suit causing the construction of a five mile force main, from the Robertsdale pump station to the plant, and the separation of combined sewers in that portion of the collection system. Work was completed in 1981 and has successfully prevented further CSO contamination of Lake Michigan from the Robertsdale area.

In 1983, the USEPA filed civil action to prevent the discharge of sewage sludge and for development of an environmentally acceptable short and long term sludge management plan. In response to this suit, the Hammond Sanitary District has retained a consultant to develop interim and long term sludge management solutions. Current plans are for removal of sufficient sludge from the existing lagoons (via a private, contract hauler) to recover partial storage capacity while a sludge dewatering system is designed and constructed for long term use. Dewatered sludge would be removed for off-site landfill disposal. Award of a USEPA construction grant to support upgrading of sludge handling facilities and emptying of sludge lagoons is probable by the end of 1984. It is not anticipated that the sludge dewatering system could be operational before 1986.

During September, 1984, the Hammond POTW was in compliance with its permit conditions. A consent judgment is under negotiation.

Brief NPDES permit histories for each of the three POTWs are presented in Table 3-2. All three POTWs are discharging under expired permits, which remain in force. New permits will be issued after completion of the wasteload allocation study currently being performed by the ISBH. In the absence of current permits, discharge requirements for East Chicago are specified by a court order; discharges from the Gary facility are controlled under a consent judgment. The Hammond facility is presently the subject of a civil suit filed in U.S. District Court by the USEPA.

TABLE 3-2

NPDES PERMIT HISTORY
OF
POTW DISCHARGERS

Sanitary District	NPDES Permit History		Compliance During September 1984
East Chicago	10/15/77	Issued	Non-Compliance with ammonia-N, phenol, cyanide, fluorides, chlorides, sulfates, oil and grease, BOD and TSS.
	10/3/79	Amended	
	8/31/81	Amended	
	5/31/82	Expired	
	11/8/82	Court Order Issued	
Gary	7/1/77	Issued	Non-Compliance with ammonia-N.
	4/6/79	Amended	
	4/30/82	Expired	
	6/15/83	Consent Judgement Issued	
Hammond	1/8/79	Issued	Compliance.
	6/30/83	Expired	

During September 1984, East Chicago and Gary were found by the State of Indiana to be in non-compliance based on violations of effluent limitations (see Table 3-2). Notices of violation are expected to be issued for these occurrences.

3.3 PRETREATMENT PROGRAMS

The goal of the National Pretreatment Program (40 CFR Part 403) is to protect municipal treatment plants and the environment from the adverse impacts that may occur when hazardous or toxic wastes are discharged into a sewage system. Pretreatment programs regulate nondomestic (i.e., commercial/industrial) users that discharge nonconventional (e.g., toxic) or unusually strong conventional wastes. The objectives of the program are to:

1. Prevent the introduction of pollutants which will cause inhibition/interference with the operation of the treatment plant, including interference with its sludge disposal
2. Prevent the introduction of pollutants which will pass through or otherwise be incompatible with the treatment plant
3. Improve opportunities to recycle and reclaim wastewaters and sludges.

The General Pretreatment Regulations (promulgated on January 28, 1981) require POTWs with design flows greater than five mgd to establish a local pretreatment program if they receive pollutants from industrial users which pass through or otherwise interfere with the operation of the plant or are otherwise subject to categorical pretreatment standards. POTWs are required to establish local pretreatment programs by July 1, 1983. States with an approved (i.e., delegated) NPDES permit program are required to develop and implement a State pretreatment program by March 27, 1980. States with approved pretreatment programs may assume responsibility for implementing the pretreatment program requirements in lieu of requiring local POTWs to develop pretreatment programs.

The State or local pretreatment program provides the legal, technical, and administrative framework for implementing and enforcing National, State and local pretreatment standards. EPA has promulgated two sets of pretreatment standards: prohibited discharge standards and categorical pretreatment standards.

Prohibited discharge standards are designed to protect the treatment plant and apply to all industrial and commercial users connected to the treatment works. These standards are contained in the General Pretreatment Regulations (40 CFR Part 403).

National categorical pretreatment standards apply to specific industries determined to be the most significant sources of toxic pollutants. Each categorical pretreatment standard contains numerical pollutant discharge limitations based on the best available technology economically achieveable (BAT) for existing industrial users, or best available demonstrated technology economically achievable for new sources. The USEPA has promulgated, or will soon promulgate, pretreatment standards for 26 industrial categories. In developing these standards, the Agency has focused on the 126 priority pollutants which are the most toxic or hazardous, and other nontoxic pollutants found to be incompatible with the treatment works. In addition to the general prohibitive standards and the categorical pretreatment standards, POTWs developing local pretreatment programs must develop and enforce specific effluent limits, for pollutants contributed by nondomestic users, to prevent interference with plant operations or pollutant pass through.

A local POTW may also request authority (from the State and/or EPA) to grant "removal credits" to industrial users to reflect removal of pollutants by the POTW. Industrial users granted such credits are permitted to discharge larger quantities of regulated pollutants to the POTW than would otherwise be permissible under the National Categorical Pretreatment Standards. However, the POTW must demonstrate that "consistent removal" occurs as the result of actual treatment processes. The POTW must also demonstrate that revision of the categorical standards(s) will not cause the POTW to violate its NPDES permit or prevent the POTW from complying with statutory provisions, regulations, or permits applicable to the POTW's sludge disposal plans.

3.3.1 State Pretreatment Program

Though the State of Indiana does not have an approved State Pretreatment Program, it has been actively involved in developing such a program. Indiana has submitted a pretreatment program application to USEPA Region V for approval, adopted the National Categorical Pretreatment Standards as State Pretreatment Standards, and enacted State Pretreatment Rules and Regulations. The State has also assumed major program activities in overviewing and coordinating the development of local pretreatment programs through a Memorandum of Understanding with Region V. Fifty-nine local POTWs have been required to develop local pretreatment programs. Categorical industries not subject to a local pretreatment program will be controlled under a State permit system.

3.3.2 Local Pretreatment Programs

In 1979, the State modified the NPDES permits for Hammond, Gary and East Chicago to require these municipalities to develop local pretreatment programs by 1981. East Chicago has submitted a revised pretreatment program to the SBA and USEPA; revised programs are expected from Gary and Hammon in the near future. All three are expected to be approved by Summer, 1985, based on current progress.

For local pretreatment programs to be effective in controlling the discharge of toxic pollutants into the treatment works, the following elements must be in place:

- Adequate legal authority and procedures to control industrial dischargers and enforce categorical and local limits
- Identification of existing and new industries subject to control
- Development of local discharge limits to prevent interference or pass through
- Procedures to determine/verify industrial compliance with discharge limits and requirements.

All three POTWs have established the necessary legal authority to enforce their proposed pretreatment program through the local s[illegible] use ordinance.

Permits containing specific discharge limits as well as monitoring and reporting requirements will be issued by the POTWs to significant industrial dischargers. Industries found to be in violation of the permit conditions may be subject to enforcement actions.

The three POTWs conducted industrial surveys to identify the industries subject to control. Results of the surveys assisted the POTWs in characterizing and quantifing the industrial wastewater discharged to the treatment systems. Analytical data on the levels of pollutants actually discharged by the industries was either limited or non-existent. However, implementation of proposed industry and POTW monitoring requirements is expected to provide this information.

Each POTW has proposed local discharge limits to prevent the discharge of toxic pollutants in amounts which would interfere with treatment plant processes, or pass through the treatment plant and cause violation of water quality standards. In developing these limits, each POTW calculated discharge concentration limits for each pollutant based on inhibition values for treatment processes, water quality standards or NPDES limits, and sludge criteria. The most stringent limit was applied and translated into discharge limits for industrial users discharging that pollutant into the sewage system.

Water quality or inhibition-based limits are expected to prevent the discharge of toxic pollutants in amounts which would cause violation of water quality standards or NPDES limits. In calculating the local limits, all three POTWs used treatment plant removal rates based on limited data or "national removal rates" documented in the "40 POTW Study." Since removal rates are a critical factor in determining the maximum pollutant loading to the treatment plant and, consequently, the amount of pollutants industries are allowed to discharge, these local limits should be re-evaluated when additional plant-specific data becomes available. A change in water quality standards or NPDES limits would also necessitate such a re-evaluation.

The following sections provide brief reviews of the status of pretreatment program development for each POTW.

3.3.2.1 Gary Pretreatment Program

The State modified the Gary NPDES permit on April 9, 1979 requiring development of a pretreatment program by June 1, 1981. Gary submitted a pretreatment program document on January 10, 1981 which EPA found unapprovable. The June 15, 1983 Consent Decree required development of an approvable program. The USEPA issued a Director's letter on December 6, 1983 requesting submittal of a document within 45 days. Gary submitted revisions to its 1981 document on March 7, 1984. The State issued an Order of Compliance on March 23, 1984 requiring submittal of a final program application by May 1, 1984. To date, Gary has not complied with this order, although a revised program application is expected soon and approval is anticipated in Summer, 1985, based on current progress.

The Gary Sanitary District has identified 19 major industries which contribute 14.5 percent (5.8 mgd) of the total influent flow. The District has limited toxic monitoring data on the discharges from these 19 industries. However, this data was not provided in the pretreatment program document submitted to the USEPA. Therefore, no estimated industrial loadings of toxic pollutants could be derived.

The industrial users discharging to the Gary POTW are known to contribute COD, TSS, phosphorus, oil and grease, cyanides and chlorides and the following heavy metals: chromium, mercury, zinc, iron, and copper. Industries have also reported discharge of the following toxic organics: naphthalene, anthracene, methyl naphthalene, acenapthene, 5-methyl acenapythlene, phenol, chloroform, carbon tetrachloride, butadiene, stryrene, 11 base-neutral compounds (not specified) and PCBs. None of these organics, except phenol, were detected in the wastewater treatment plant's effluent.

Ten of the nineteen major industries are subject to National Categorical Pretreatment Standards. Four industries are subject to Iron and Steel Standards; four industries are subject to Metal Finishing Standards and one industry is subject to Pulp and Paper Standards.

In addition to enforcing the categorical pretreatment standards, Gary will impose local discharge limits on all industrial users. Proposed local industrial discharge limits for the Gary, Hammond and East Chicago POTWs are provided in Table 3-3. Gary has not proposed industrial discharge limits on phenols, or oil and grease of mineral or petroleum origin.

3.3.2.2 Hammond Pretreatment Program

The January 8, 1979 NPDES permit for the Hammond POTW required development of a pretreatment program by June 1, 1981. Hammond submitted a document which EPA determined to be unapprovable. EPA issued a Director's letter on February 1, 1984 requesting submittal of a pretreatment program document within 45 days. An Administrative Order was issued on April 30, 1984 requiring submittal of a document by June 1, 1984. Hammond submitted a pretreatment program document on June 7, 1984. A revised program application is expected to be submitted soon and approval is anticipated in Summer, 1985, based on current progress.

The Hammond Sanitary District identified 21 major industrial dischargers which contribute 10 percent (4 mgd) of the total influent flow. These industries report discharging the following pollutants: oil and grease, cyanide, cadmium, copper. chromium, nickel, lead, zinc, silver, phenol, benzene, ethylbenzene, toluene, 1,1,1-trichloroethane, benzidine, methylene chloride, tetrachloroethylene, 1,2-transdichloroethylene, chloroform, and chloroethane. Actual industrial loadings of these pollutants are not known.

Hammond has nine industries potentially subject to categorical pretreatment standards. Two industries are subject to Iron and Steel Standards; two industries are subject to Electroplating/Metal Finishing Standards, and one industry is subject to Pulp and Paper Standards. In addition, four chemical companies may be subject to Organic or Inorganic categorial standards.

Hammond has proposed local industrial discharge limits for metals, phenols, and oil and grease. In addition, discharge of PCBs is prohibited. The Hammond POTW proposed local discharge limits are provided in Table 3-3.

TABLE 3-3

PROPOSED INDUSTRIAL DISCHARGE LIMITS FOR THE GARY, HAMMOND, AND EAST CHICAGO POTWS

Parameter (mg/l)	Gary	Hammond	East Chicago
Cd	0.25	0.17	0.14
Cr	6.0	25	—(1)
Cu	2.5	0.2	0.27
Pb	1.0	1.8	2.8
Fe	—	—	1.5 (soluble)
Hg	0.7	0.04	0.002
Ni	2.7	12.4	0.39
Ag	—	0.24	0.47
Zn	1.6	1.9	5.5
CN	1.0	0.45	1.63
Phenols (4-AAP)	—	0.5	20.76
O&G	—	200	50
O&G (mineral or petroleum origin)	—	100	50
PCBs	—	No discharge allowed	—
Total Phosphorus	—	—	3.7
Fluoride	—	—	2.2
Thallium	—	—	1.25
Methylene Chloride	—	—	0.95
Fluoranthene	—	—	0.69
bis (2-ethylhexy) Phthalate	—	—	1.03

(1) Dashes indicate no limits specified.

3.3.2.3 East Chicago Pretreatment Program

On October 3, 1979, the State modified the East Chicago NPDES permit, requiring development of a pretreatment program by January 1, 1981. East Chicago submitted a pretreatment program document on March 1, 1982 which the USEPA subsequently determined to be unapprovable. USEPA issued a Director's letter on December 6, 1983 requesting submittal of a revised document within 45 days. USEPA then issued an Administrative Order on March 8, 1984 requiring submittal of a program application by June 1, 1984. East Chicago responded to this order by submitting various pretreatment program documents on March 29, April 24 and May 17, 1984. Revised program documents were submitted to the State and USEPA in November, 1984. Program approval is anticipated by Summer, 1985, based on current progress.

The East Chicago Sanitary District has sampled its major industrial users since 1981 and has identified 51 major industrial discharge sources. Using the District's 1983 industrial monitoring data, and the results of the three-day toxic sampling program on the POTW influent and effluent, the toxic loadings to the treatment plant attributable to industrial sources were estimated. These estimates are presented in Table 3-4. The total industrial flow (3.72 mgd) is 24 percent of the total influent flow to the treatment plant and contributes the following toxic metal loadings to the treatment plant: 62 percent of the nickel, 31 percent of the zinc, 30 percent of the cadmium and lead and 4 percent of the copper.

Although the industrial discharge data indicated a total loading of 1,094 lbs/day of phenols to the POTW, the plant influent data reflect a total loading to the plant of only approximately 17 to 63 lbs/day. This discrepancy may be due to:

- The limited influent phenol data (the 1,094 lbs/day calculation is based on a single, three-day sampling period), or
- Volatization of the phenols in the sewer collection system.

Longer term monitoring is required to confirm the actual phenol loading rates to the POTW from industrial sources.

TABLE 3-4

INDUSTRIAL TOXIC POLLUTANTS DISCHARGED TO EAST CHICAGO SANITARY DISTRICT POTW

(lbs/day)

	Total Influent Loading	Industrial Loading	Percent Industrial Loading
Cadmium	5.21	1.56	30%
Copper	65.18	2.43	4%
Nickel	6.52	4.04	62%
Lead	23.46	7.08	30%
Zinc	78.21	24.10	31%
O&G	—	893.46	--
Phenols	16.95 - 62.57	1093.72	6%

Approximately 45 percent of the major discharges to the East Chicago POTW are subject to National Categorical Pretreatment Standards. The types of categorical industries included are listed below:

Aluminum forming - one industry (one discharge point)
Foundries - two industries (four discharge points)
Inorganic Chemicals - one industry (one discharge point)
Iron and Steel - three industries (16 discharge points)
Nonferrous Metal Manufacturing - one industry (one discharge point).

All industries are subject to local discharge limits. Those industries subject to both local and Federal categorical pretreatment standards must comply with the more stringent limits. Table 3-3 lists the proposed East Chicago local discharge limits.

Until the State and local POTWs have approved pretreatment programs, Region V is the Control Authority for implementing and enforcing the National Categorical Pretreatment Standards. Industries subject to categorical pretreatment standards (as promulgated by USEPA) are required to be in compliance within three years of the effective date of promulgation. Industries subject to the Iron and Steel categorical standards must be in compliance by July 10, 1985.

3.4 MUNICIPAL WASTEWATER TREATMENT PROGRAM

Federal grant assistance for the construction of wastewater treatment works was initiated under an authorization included in the Federal Water Pollution Control Act of 1956 (Public Law 84-660). Major amendments to this legislation occurred with passage of the Clean Water Act of 1972 (Public Law 92-500). Subsequent amendments occured with passage of the Clean Water Act of 1977 (Public Law 95-217). Further amendments occurred in 1980 and 1981, under Public Laws 96-483 and 97-117, respectively.

The municipal wastewater treatment works Construction Grants Program is currently operated under the provisions of Public Law 97-117. The Construction Grants Program provides Federal grant assistance to assist municipal governments in meeting the wastewater treatment and pollution control requirements of the Clean Water Act, as amended.

A provision common to all Federal wastewater treatment grants programs, from the Federal Water Pollution Control Act through the present, is the relegation of priority setting for individual projects to the States. Changes have occurred over the history of the grants programs, however, with respect to both the annual appropriation amount and the maximum percentage of the project eligible for grant assistance.

Under Public Law 84-660, up to 30% of project costs (not to exceed $250,000) were grant eligible. This increased to 55% (and the maximum amount limitation was deleted) in the mid 1960's and peaked at 75% (up to 85% for innovative and alternative projects) with passage of Public Law 92-500. Under the provisions of the present legislation (Public Law 97-117), the maximum decreased to 55% of eligible project costs on October 1, 1984. Also, the grant eligibility requirements have been made more strict.

Federal Grant assistance for water pollution control is generally available for planning and design, facilities construction, and personnel training. Although the grants are administered by the individual States, the grantees are required to comply with general USEPA Construction Grants Program requirements as well as specific project limitations which may be imposed by either the State or USEPA. Federal Construction Grants Program regulations are provided in 40 CFR Part 35, Subpart E.

The GCR/IHC tranverses three political jurisdictions (ie; municipalities) which are eligible for Federal grant assistance under the Construction Grants Program. These municipalities (Gary, Hammond and East Chicago) have all participated in the program, receiving variable grant amounts for facilities planning, construction, operator training and special purpose investigations, such as sewer system evaluation surveys.

Since 1970, more than $108 million in Federal grant assistance has been provided to the cities of Gary, Hammond and East Chicago. In addition, Federal grant monies allocated to the State of Indiana are currently being used to fund a Wasteload Allocation Study (WLA) for the GCR/IHC. The WLA, which is currently in progress, was funded with $350,000 from the Section 205 (j) budget for FY82.

A summary of construction grants awards to Gary, Hammond and East Chicago, and the status of facilities planning in these POTWs, is provided below.

3.4.1 Gary POTW

The Gary Sanitary District initiated participation in the Construction Grants Program in 1973. Grants were received for facilities planning and construction, including targeted grants for sewer system evaluation and rehabilitation. Since 1973, six major grants have been received by Gary; although construction is complete on the earlier grants, none have been closed out.

The Gary Sanitary District formally initiated Facilities Planning activities in 1975, with receipt of a Federal grant to support planning studies. Approximately $2 million in grant money has been provided to support continuing planning activities. This effort has resulted in a series of segmented facilities planning reports addressing various aspects of the wastewater system.

Facilities planning efforts have been concluded for the Gary POTW. With the exception of solids handling and disposal components, all elements of the facilities plan have been approved. The solids handling and disposal component is currently in review. Plant expansion and upgrading (to advanced wastewater treatment) has been completed. The sewer system evaluation survey for large diameter sewers and sewers of more than 50-years in age has been completed and sewer rehabilitation is currently underway. Major combined sewer overflow control programs have not been recommended for the Gary system as a result of the planning studies and evaluations.

In total, Gary has received over $100,000,000 in grants related to the upgrading of the sewage collection, conveyance and treatment system. It is currently estimated that an additional $50,000,000 (approximately) is needed for construction of required sludge handling, sewer rehabilitation and plant appurtenances. Gary has applied to the USEPA for a sludge handling grant ($30-40 million requested). A training grant (approximately $640,000) for treatment plant operators was awarded in March, 1984.

Due to the previous grant-supported construction projects, the major remaining weak point in the sewage system is in sludge handling facilities. However, as mentioned above, Gary may be ineligible for the grant assistance which would be a necessary prerequisite to construct these facilities. Consequently, the Sanitary District may be required to comply with environmental regulations but be unable to finance the improvements necessary to achieve compliance. Rapid deterioration of new equipment and lack of a replacement fund are conditions which are jeopardizing the existing Federal investment in the treatment works.

3.4.2 Hammond POTW

The Hammond Sanitary District initiated facilities planning activities in the early 1970's and has received approximately $500,000 in grant support for planning. Planning investigations have included Combined Sewer Overflow studies, infiltration/inflow studies, sewer system evaluation surveys and engineering evaluations of possible sludge handling and nitrification improvements.

Facilities planning for the Hammond sewerage collection system is essentially complete. The infiltration/inflow study has been approved; combined sewer overflow discharges to Lake Michigan have been eliminated (through construction of the Robertsdale pumping station and force main); an inter-municipal combined sewer overflow study has been completed (with East Chicago and Gary); and a sewer system evaluation survey was conducted (in the Robertsdale area).

The combined sewer overflow study is being reviewed by the State of Indiana and has not yet been forwarded to the USEPA for review. This study recommended full sewer separation for Hammond (no-action was recommended for Gary and East Chicago). Although it may be cost-effective to separate combined sewers in certain portions of the sewer system (as was the case in the Robertsdale area), it is doubted that the full separation alternative recommended in the CSO study will be found to be cost-effective. The Robertsdale combined sewer overflow control project, which eliminated raw sewage discharges to Lake Michigan, was facilitated by a 1981 grant of over $6 million.

A modification to the sewer use ordinance has been approved by the City of Hammond to increase user charges. The increased revenues will be used by the Sanitary District to meet increasing operation and maintenance costs.

3.4.3 East Chicago POTW

The East Chicago Sanitary District initiated participation in the Contruction Grants Program in 1975 with receipt of a grant for facilities planning. This effort has been facilitated by more than $100,000 in Federal grant support. In 1976, East Chicago's facilities planning grant was increased by approximately $500,000 for performance of a sewer system evaluation survey. The focus of East Chicago's facilities planning process has been on evaluation of the condition of existing facilities and determination of additional treatment needs.

Since 1975, the East Chicago Sanitary District has received approximately $1.4 million for facilities planning. It is currently estimated that an additional $35 million (approximately) will be needed to meet wastewater treatment needs through the year 2000. These costs are associated with renovation of existing primary and secondary treatment units, addition of advanced wastewater treatment facilities, and renovation of sludge handling equipment.

The facilities plan concluded that combined sewer overflow corrective measures would not be necessary; therefore, no plans exist for CSO control programs in the facilities plan. However, the USEPA may elect to investigate CSO controls in more detail and re-evaluate the need for additional controls.

The East Chicago Sanitary District has experienced difficulties in completing facilities planning activities. Progress has been minimal and those reports and plans which have been completed and submitted have been found to be seriously deficient, by the State of Indiana and USEPA.

The infiltration/inflow analysis is the only element of the overall facilities planning process to be approved; such approval being a necessary prerequisite for initiation of a sewer system evaluation survey. Other submittals which have not been approved, due to major deficiencies or inadequacies, include the sewer system evaluation survey report and a facilities plan segment which addressed rehabilitation of the existing plant. An application for a grant amendment for pretreatment program development was returned due to major deficiencies.

Delays in completing facilities planning efforts in East Chicago have been complicated by administrative and financial problems. For example, grant payments from USEPA to East Chicago for ongoing facilities planning activities have been co-mingled with other City funds and payments to consultants have been delayed. These delays resulted in a successful lawsuit against East Chicago brought by the consultant, for payment.

Additional delays have resulted from termination of East Chicago's consulting contract with their facilities planning engineer. Activities toward completion of the facilities plan will be essentially suspended pending selection of a new consultant. East Chicago has selected TenEch Environmental Engineers, Inc., to complete the facilities planning process.

Two major issues which must be addressed by the new facilities planning consultant selected by East Chicago are completion of the facilities planning process and construction of sludge handling facilities. Because the existing sludge lagoon system is filled to capacity, East Chicago has initiated efforts for off-site sludge disposal. A plan for land application of sludge from the lagoon system was initiated, but subsequently stopped due to apparent violation of competitive bidding requirements. East Chicago now intends to advertise for competitive bids for this work and anticipates selection of a sludge disposal contractor, in 1984.

East Chicago has retained contractors for the cleaning of its major sewers and that work has begun. The smaller sewers can be kept clean with district staff but the six major sewers have not been properly cleaned in years. Sewer cleaning work is expected to be completed during 1984 and will help to reduce combined sewer overflows.

CHAPTER 4. SUMMARY AND CONCLUSIONS

Environmental problems in the Grand Calumet River/Indiana Harbor Canal (GCR/IHC) include high concentrations of conventional, nonconventional and toxic pollutants in the sediments and overlying water column. Although improved point source controls have resulted in significant improvements in ambient water quality conditions in recent years, the contaminated sediments continue to represent a major in-situ reservoir of accumulated pollutants.

Although compliance problems persist for municipal dischargers, major regulated industrial pollutant sources are generally in compliance with their NPDES discharge limits. However, these limits are based largely on oxygen-demanding substances (e.g., BOD, COD, nitrogen, ammonia). While DO values in the GCR/IHC have risen dramatically in recent years, biological recolonization of the river has been limited. Given the current status of point source controls, it is suspected that continued discharge of toxic and nonconventional pollutants (including contaminants leaching from sediments) are now the major limitation to the biological recovery of the GCR/IHC system.

Principle sources of toxic and nonconventional pollutants to the GCR/IHC include industrial contaminants passthrough from municipal wastewater treatment plants, combined sewer overflow (CSO) discharges, potential contributions from groundwater discharge and, to a lesser extent, direct industrial discharges and pollutant cycling from contaminated sediments. Existing environmental/regulatory programs provide a vehicle for control of many pollutant sources and significant reductions in total pollutant loadings have been achieved in recent years.

The purpose of the Master Plan is to provide a management and implementation plan for 1) achieving the maximum control of pollutants possible under existing regulatory programs and 2) developing and implementing such additional control programs as necessary to reduce total pollutant loadings to levels which permit achievement of water uses designated under the water quality standards program.

4.1 ENVIRONMENTAL PROBLEMS

Aquatic Habitat

Historically, the quality of the GCR/IHC as habitat for fish and other aquatic organisms has been severely degraded. Pollutants from industrial and municipal point source discharges have depressed DO concentrations to below the levels necessary to sustain a balanced aquatic community. Also, river sediments have become contaminated with conventional, nonconventional and toxic pollutants, further degrading the quality of the aquatic environment. Finally, man-made changes in the river channel have diminished the quality and quantity of natural habitat areas in the GCR/IHC.

In recent years, significant improvements have been realized in control of industrial and municipal point source discharges of conventional and nonconventional contaminants. As a result, average DO values have returned to levels capable of supporting a balanced aquatic community. Overall, the incidence of water quality standards violations in the GCR/IHC has decreased dramatically since 1977. The number of violations decreased by more than 60%, from 1977 through 1983, in the East Branch. More than a 75% reduction in violations was observed in the IHC during this same period. However, less than a 30% reduction was observed during this same period in the West Branch, which continues to exhibit the most degraded water quality conditions of the GCR/IHC system, based on ISBH monthly monitoring data.

Sediment quality has not significantly improved over the past ten years. Although average concentrations of certain toxic metals have decreased (lead and zinc, in particular), concentrations of other metals have remained roughly constant. Significant levels of oil and grease and organic contaminants (including PCB's, PAH's, phenols and other organics) persist in the sediments. Based on the USEPA Region V Guidelines for the Pollution Classification of Great Lakes Harbor Sediments, the GCR/IHC sediments are considered heavily polluted for all tested metals except mercury, and polluted to heavily polluted for PCB's. Average mercury levels were near the threshold concentration for classification as polluted.

Wide variations exist between the various sediment contaminants in their bioavailability and the rates at which they are exchanged between the sediments and overlying water column. A preliminary comparison of available sediment contaminants data and established water quality criteria indicated the greatest concern for heavy metals (particularly mercury and cadmium), PCBs, certain PAHs (the two and three membered rings), phenol and bis (2-ethylhexyl) phthalate.

Small natural areas exist along the GCR/IHC which provide habitat for aquatic flora and fauna. Limited field surveys indicate that these areas may be expanding. Emergent vegetation (e.g. cattails) may be restricting movement of sediment deposits.

Biota

Historically, aquatic biota have been depressed in the GCR/IHC, both with respect to species diversity and population density. Only reduced numbers of aquatic earthworms (oligochaetes) were found in benthic samples in the 1960's. The density of oligochaetes increased by a factors of 100 to 4600 in the same areas in a 1973 survey.

In a 1983 fish survey, 16 species of fish were collected in the Indiana Harbor Canal (the River was not sampled during this survey). These results are interpreted as evidence of recolonization of the GCR/IHC, reflecting improving water quality. The potential for bioaccumulation and biomagnification of toxics in aquatic organisms (particularly the benthos) is recognized, but cannot be quantified with the existing data base.

4.2 POLLUTANT SOURCES

Principal pollutant sources include industrial and municipal wastewater discharges, CSOs and non-point runoff. Because industrial and municipal point sources have been subject to regulatory control for over a decade, these sources are the most completely understood. However, until recently, most data from these sources concentrated on conventional and nonconventional contaminants. Little historical data exist from these sources regarding toxics; this data is only now beginning to be collected.

4.2.1 Industrial Point Sources

Based on NPDES records at USEPA Region V, seven major industries discharge to the GCR/IHC, including Citgo Petroleum, E. I. duPont, Inland Steel, J&L Steel, U.S.S. Lead Refinery, U.S. Steel, and Vulcan Materials. A number of minor dischargers also exist, including Industrial Disposal, American Steel Foundries, Blaw Knox Foundry and Explorer Pipelines. Of the minor dischargers, Industrial Disposal Company is most significant based on daily loading rates.

Three major dischargers (Inland Steel, J&L Steel and U.S. Steel) account for approximately 90% (by flow volume) of industrial point source discharges to the GCR/IHC, totalling more than 1,000 mgd. These three steel mills, together with DuPont and Industrial Disposal, contribute the bulk of the industrial pollutants discharged.

Because most combined wastewater from the five principal industrial sources is noncontact cooling water, effluent quality is relatively good. Total BOD loading from these sources is very low, relative to discharge volume, especially in comparison with POTW discharges.

Industrial outfall monitoring data include conventional contaminants, nonconventional contaminants and a few metals. Sufficient data is only now becoming available to evaluate the toxics loading from the direct discharge industrial sources. In re-issuing industrial NPDES permits, Indiana is requiring full analytical testing for toxic organic compounds and is incorporating limits on these compounds in the new permits. Little is known about the biological impacts of toxic constituents in these discharges on the GCR/IHC.

4.2.2 Municipal Wastewater Sources

Three POTWs discharge to the GCR/IHC, representing the Gary, Hammond and East Chicago Sanitary Districts. The Gary plant discharges to the East Branch while the Hammond and East Chicago plants discharge to the West Branch. Due to flow patterns in the West Branch, however, the Hammond POTW effluent enters that portion of the West Branch draining to the IHC only under certain flow conditions.

Historically, these POTWs have represented major sources of biological contaminants discharged to the GCR/IHC. Recent improvements to these plants have reduced effluent loading rates. Daily BOD loadings from the Gary, Hammond and East Chicago POTWs have been reduced by 32%, 96% and 25%, respectively, from 1968 to 1982.

Comparing 1968 to 1982, total wastewater flows treated by these POTWs have decreased for Gary (by 15%) and increased for Hammond and East Chicago (by 13% and 38%, respectively). These POTWs have traditionally received large quantities of industrial flows from the service areas. However, until recently, effluent monitoring was conducted primarily for only conventional and nonconventional contaminants. All three are currently developing industrial pretreatment programs in response to Federal regulations (40 CFR 403). Influent and effluent sampling conducted in support of pretreatment program development have indicated the presence of toxic compounds, including organics and heavy metals, being discharged to the POTW (full data is not yet available for Hammond).

Tests conducted in February, 1980 on the East Chicago effluent revealed this discharge to be highly toxic to fish and also indicated the presence of mutagenic compounds. Available toxic pollutants data are insufficient to evaluate the relative impacts of the three POTWs on aquatic life in the GCR/IHC.

4.2.3 Combined Sewer Overflows

Fourteen CSO's discharge a combined, estimated total of over 11 billion gallons per year to the GCR/IHC. It is calculated that over 50 percent of the annual CSO volume is discharged to the GCR/IHC within eight miles of Lake Michigan. These outfalls have contributed to fecal coliform contamination of near-shore Lake Michigan.

The water quality impacts of CSO's on southern Lake Michigan are under investigation in a USEPA-sponsored modeling study and, in a more limited way, in an ISBH-sponsored wasteload allocation study.

Both of these studies, however, are concentrating primarily on conventional and nonconventional contaminants and BOD/DO interactions. The impacts of CSO's on water quality and biological habitat, as a result of toxics bypassing, is largely undocumented. However, limited data from one CSO in East Chicago indicate substantial daily loading rates for heavy metals and other toxics (e.g., over 1,000 pounds/day phenol; over 5 pounds/day lead; 3.5 pounds/day nickel and 1.5 pounds/day cadmium). Over 30 industrial discharges to the collection system exist upstream of this CSO.

Insufficient data are available to quantify the CSO impacts on water qualtiy and biological habitat in the GCR/IHC. However, based on the limited POTW influent monitoring data, the CSO's are believed to represent major sources of toxic pollutants to the river.

4.2.4 Non-Point Sources

A variety of non-point sources may contribute to toxic pollutants loading to the GCR/IHC. These include highway runoff; runoff from industrial sites near the river; seepage of contaminated groundwater from dumps, landfills and waste lagoons; rain scour and dust fall; and illegal dumping.

A review of USEPA and State ERRIS and NPL file data revealed 38 waste disposal/storage sites ("wastefills") in the GCR/IHC basin of northwest Indiana. Eleven of these sites are within one fifth mile of the river bank; several are essentailly on the banks of the river. A number of additional wastefill sites have been tentatively identified by the State and are currently under review.

Limited file data is available for these wastefills. However, it is known that one site (the Gary POTW sludge lagoon) is contributing to PCB contamination of the river. Possible lead contamination is being investigated at another site.

Even less is known about the potential magnitude of other non-point sources (e.g., highway runoff, rain scour, dust fall, etc.). However, based on their number and immediate proximity to the riverbanks, wastefill sites are targeted as the priority non-point sources for further investigation.

4.3 CONTROL PROGRAMS

Existing water quality control programs include NPDES permits for municipal and industrial dischargers, the municipal pretreatment program and the construction grants program. Other control programs (e.g., RCRA and CERCLA) may also be applied to specific problems.

4.3.1 Water Quality Standards and Industrial Effluent Guidelines Programs

The basis for water quality controls are the water quality standards and effuent guidelines programs. Direct industrial dischargers are required to comply with technology based standards. Industries were required to meet BPT standards by July 1, 1977 and BAT and BCT standards by July 1, 1984.

Where technology based standards are insufficient to meet water quality objectives, such additional treatment as is necessary for compliance with water quality based standards is also required. The need for water quality based standards is evaluated under the State water quality management process (Section 303 of the CWA).

Water quality standards for particular streams consist of a designated use(s) and ambient water quality criteria to protect that use(s). If a State wishes to adopt a use designation other than "fishable/swimmable", a use attainability analysis is required, indicating what the practical limitations are.

The USEPA has promulgated specific procedures which States must follow in developing and revising water quality standards; the Agency reviews the State programs periodically to ensure compliance. The USEPA provides financial assistance to the States (under Sections 106 and 205 of the CWA) to assist in water quality management and planning. States are required to review and update their water quality standards every three years, at a minimum.

Water quality standards for the GCR/IHC were first promulgated in 1967. The original standards were revised in 1973 and 1978. Following the 1973 revisions, the water quality standards for the GCR/IHC were considered to be comparatively advanced and were effective in achieving substantial water quality improvements in the system. In 1978, the State established a designated use for the GCR/IHC for "...partial body contact, limited aquatic life and industrial water supply." This use designation allows the establishment of water quality standards less stringent than those established for recreational use waterways. However, the CWA requires that stream standards protect downstream uses, and GCR/IHC standards must be adequate to protect the separate standards established for Lake Michigan, Indiana Harbor and the Illinois River.

The State also established an antidegradation policy in 1978. This policy requires that existing instream beneficial uses be maintained and that water quality in streams exceeding the minimum standards be maintained at these higher levels. Limited degradation is permitted only if justified on economic and social grounds.

The State water quality standards for the GCR/IHC, promulgated in 1978, concentrated primarily on conventional and nonconventional parameters. Because these standards were promulgated before the USEPA National Ambient Water Quality Criteria, the numerical standards which were included in the 1978 revisions did not reflect the currently-available toxic pollutant criteria. Narrative standards were included, however.

The 1978 use designation did not fully include the "fishable/swimmable" uses specified in Section 101(a)(2) of the CWA. Also, more than three years have elapsed since the last revision to the State standards. Unless the water quality standards are revised to include the Section 101(a)(2) uses, the State must conduct a use attainability analysis, in accordance with USEPA guidance. If practical limitations exist to attainment of the "fishable/swimmable" uses, these limitations must be identified and an alternative designated use(s) must be specified, as supportable by the results of the analysis. This analysis must also consider downstream water uses. Also, the State should develop and specify the methods to be used for implementing its antidegradation policy (none currently exist).

Because the existing water quality standards are more than six years old, the State must adopt new standards to protect the existing or revised designated uses. These standards must be consistent with the National water quality criteria for toxic pollutants, ammonia, chlorine and DO. Criteria are to be developed based on 1984 USEPA guidelines.

The State may adopt pollutant-specific numerical criteria, narrative criteria or a combination of the two for toxic pollutants. If narrative criteria are adopted in lieu of numerical criteria (which is presently the case for the GCR/IHC), the State should specify the methods which will be used to regulate point sources for control of toxic, persistent or bioconcentrating pollutants.

The State is currently evaluating existing water quality standards through an ongoing WLA study. Effects on Lake Michigan (a downstream water body) are being considered in the WLA effort as well as in another ongoing modelling study, under Federal contract. The results of the WLA study will contribute to revisions of existing discharge limits applicable to the GCR/IHC, currently being developed by the State under the NPDES program.

4.3.2 NPDES Program

The CWA requirements for reduction of point source pollutant discharges are implemented through the NPDES permit system authorized in Section 402 of the Act. NPDES permits have a set lifespan of from several months to a maximum of five years. The permittee must comply with NPDES permit conditions for continued discharge. The permittee must also apply for permit renewal before expiration or in the event of major changes in treatment or manufacturing processes.

Industrial Dischargers

Seven major and four minor industrial dischargers exist on the GCR/IHC, many of which have multiple discharge points. Pertinent data from the seven major dischargers are summarized as follows:

Industry	Flow (mgd)	Date of Most Recent Permit	Scheduled Permit Expiration Date	Compliance in Third Quarter 1984
Citgo	Intermittant	12/14/81	11/30/86	Yes
DuPont	4.70	1/1/79	6/30/81	Yes
Inland Steel	592	3/6/84	2/89	Yes
J & L Steel	154	2/27/81	6/30/81	Yes
U.S.S. Lead	0.06	6/10/75	3/31/80	No (total lead)
U.S. Steel	309	6/1/83	5/31/88	Yes
Vulcan Materials	0.12	8/5/81	7/31/86	Yes

State and USEPA effluent monitoring during the fourth quarter 1984 indicated significant violations of total lead limits at U.S.S. Lead. U.S. Steel was in noncompliance for daily average zinc levels in September, 1984.

Current NPDES permits control primarily conventional, nonconventional and selected other contaminants, including:

- Oil & Grease
- pH
- BOD
- Suspended Solids
- Dissolved Solids
- Chlorides
- Fecal Coliforms
- Chlorine Residual
- Flouride
- Temperature
- Sulfates
- Phosphorus
- Ammonia
- Lead
- Zinc
- Cyanide
- Phenols
- Chromium
- Copper
- Nickel
- Tin
- Arsenic
- Mercury

The range of parameters controlled varies widely from outfall to outfall.

Generally, the industrial dischargers have achieved compliance with BPT, BAT and BCT standards and are generally in compliance with existing NPDES permit conditions. However, more information is needed regarding toxics discharged from these facilities and resulting impacts on the biological habitat of the GCR/IHC. Toxicant studies on blast furnaces, coke plants and cold rolling mills have been completed, or are in progress, at steel facilities.

Municipal Dischargers

Three POTWs, representing the Gary, Hammond and East Chicago Sanitary Districts, discharge treated wastewater to the GCR/IHC. Pertinent data from these dischargers are summarized as follows:

POTW	Approx. Flow	Date of Most Recent Permit	Scheduled Permit Expiration Date	Compliance in September 1984
Gary SD	41.4 mgd	7/1/77	4/30/82	No (NH^3)
Hammond SD	37.9 mgd	1/8/79	6/30/83	Yes
East Chicago SD	15.6 mgd	10/15/77	2/2/82	No (NH^3, Phenol, CN, Fluorides, Chlorides, Sulfates, O&G, BOD, TSS)

All three POTWs are discharging under expired NPDES permits. New permits will be issued after completion of the WLA.

All three POTWs have experienced chronic problems in meeting NPDES discharge limitations. All have a history of court ordered compliance mandates and consent judgements. The Gary POTW is deteriorating rapidly and suffering from poor O&M practices. In addition to the NPDES permit, the Gary POTW is regulated by a Federal consent judgement. The USEPA is pursuing enforcement action against Gary for violation of this judgement.

The Hammond POTW has completed substantial plant improvements and has controlled major CSO sources. Sludge handling practices are inadequate and on-site sludge lagoons are at capacity. However, award of a USEPA construction grant to support upgrading of sludge handling facilities and partial emptying of sludge lagoons was made in September, 1984. The POTW is the subject of a USEPA law suit.

The East Chicago POTW has completed major plant improvements, under the terms of a Federal court ordered consent judgment. However, the plant is still unable to meet NPDES discharge limitations. Negotiations are continuing to develop a comprehensive pollutant abatement schedule.

Discharge limitations for the three POTWs control primarily conventional and nonconventional contaminants, including:

- BOD
- Ammonia
- Chlorides
- Flourides
- Oil and Grease
- Phosphorus
- Suspended Solids
- pH
- Sulfate
- Fecal Coliforms
- Cyanides
- Phenol
- Flow Rate

All three POTW's receive substantial industrial flows. However, available data are inadequate to evaluate the degree of toxic pollutants passthrough which may be occurring, or the resulting impacts on the GCR/IHC.

4.3.3 Pretreatment Program

The National Pretreatment Program is described in 40 CFR Part 403. The pretreatment program is intended to protect both the POTW and the receiving waters from harmful constituents included in industrial effluents discharged to the collection system. Specifically, the program prevents the introduction of pollutants which inhibit or otherwise interfere with the treatment works, reduce opportunities for recycle or reuse of sludge, or pass through the plant to receiving waters.

Under pretreatment program regulations, the Gary, Hammond and East Chicago POTWs are required to develop local pretreatment programs: all three receive substantial industrial flows, including industries subject to categorical pretreatment standards, and all treat design flows of over five mgd.

Although Indiana does not yet have a state approved pretreatment program, an informal draft program application has been made to the USEPA and Indiana has assumed de facto delegation of major program review activities. All three

POTWs have been required to prepare pretreatment programs. In response to USEPA orders issued under Section 309 of the CWA, all three POTWs have submitted program applications to the USEPA. These program applications were prepared using USEPA guidance for local pretreatment program development.

All three POTWs have identified industries subject to control and have proposed local limits for discharges to the collection system, based on influent sampling and industrial discharge data. These limits are intended to protect the treatment plant and to prevent pollutant passthrough, which interferes with POTW compliance with Water Quality Standards. The limited constituents are summarized as follows:

POTW	Constituents Limited
Gary	Metals, Cyanide (CN)
Hammond	Metals, CN, Phenols, Oil & Grease (O&G), Mineral or Petroleum origin O&G, PCBs ("no discharge allowed")
East Chicago	Metals, CN, Phenols, O&G, Mineral or Petroleum origin O&G, total Phosphorus (P), Flouride, Thallium, Methylene Chloride, Flouranthene, bis (2-ethylhexy) Phthalate

Limited metals include cadmium, copper, lead, mercury, nickel, and zinc for all three POTWs, in addition to chromium for Gary and Hammond, soluble iron for East Chicago, and silver for Hammond and East Chicago. Although additional pollutants (including toxics) are known to be discharged to these POTWs, many of these compounds were not detected in the POTW effluents and were therefore not added to the list of controlled constituents.

The USEPA is currently completing review of the revised POTW pretreatment program documents submitted by East Chicago and is anticipating receipt of revised program documents from Gary and Hammond in early 1985. All three programs are expected to be approved by Summer, 1985. After program approval and implementation, the resultant monitoring of industry and POTW effluents will provide additional data to determine the extent of toxics passthrough to the GCR/IHC. The existing data are marginally sufficient to indicate those toxic pollutants for which additional monitoring is required.

4.3.4 Municipal Wastewater Treatment

The NPDES and pretreatment programs regulate the quality of wastewater effluent discharged from POTWs. The construction grants program (Section 201 of the CWA) provides financial assistance to municipal POTWs for construction of sewerage conveyance and treatment systems to assist in meeting discharge limitations. These funds are provided through the delegated State programs, on the basis of State priorities, and are generally available for planning and design, facilities construction, and personnel training. Grantees are required to comply with general USEPA requirements as well as any additional State or USEPA conditions specific to the POTW.

Since 1970, more than $108 million in Federal grant assistance has been provided to the Gary, Hammond and East Chicago POTWs. Overall, the progress of facilities planning for all three POTWs has been slow; despite the more than 10 years since these municipalities initiated participation in the 201 program, substantial program elements have yet to be completed.

Six major grants have been received by Gary, for planning, construction and operator training. Facilities planning has been concluded and all elements of the plan have been approved except solids handling and disposal, which remains as the weak point in the overall sewerage collection, transport and treatment system. Gary has applied for $30-40 million in grant assistance for improvements to the sludge handling system. However, the USEPA has denied this request because the proposed solution was not found to be cost effective and failed to address the issue of PCB-contaminated sludge in the Ralston Street lagoon.

Facilities planning in Hammond is also essentially complete. Construction of the AWT facilities is complete and has resulted in 95 percent reductions in BOD and solids loading to the GCR/IHC. A CSO study is under review by the State. This study recommends full sewer separation. Evaluation of CSO impacts on water quality is underway.

East Chicago has experienced chronic problems in completing facilities planning activities. Progress has been minimal and those reports and plans which have been completed have been found to be seriously deficient by the State and USEPA. The Infiltration/Inflow (I/I) analysis is the only facilities planning element which has been approved. The Sewer System Evaluation Survey (SSES) report and a facilities plan segment addressing rehabilitation of the existing plant were returned due to major deficiencies. An estimated $35 million is required to meet wastewater treatment needs through the year 2000, for renovation of existing primary and secondary treatment units, addition of AWT facilities and renovation of sludge management facilities. Progress toward completion of facilities planning has been suspended while East Chicago selects a new consultant. While no plans for CSO control presently exist, the need for such controls is being re-evaluated by the USEPA.

5. RECOMMENDATIONS

Water quality in the Grand Calumet River/Indiana Harbor Ship Canal (GCR/IHC) has improved dramatically in the past 10-15 years, however, improvements in the West Branch have been more limited. Dissolved oxygen levels were once too low to support any but the most pollution tolerant aquatic species, and even these organisms were greatly reduced in numbers. Today, average DO levels are adequate to support a varied species assemblage of freshwater fish and other aquatic organisms, and recent data suggest that some recolonization of the GCR/IHC has begun.

Significant reductions in point source pollutant loading rates have been achieved through both municipal and industrial effluent controls. These controls have focused on regulation of conventional and non-conventional contaminants, which are closely related to DO levels in the receiving water. As these pollutants have come under increasing control, the potential importance of toxic pollutants to the water quality and aquatic habitat of the GCR/IHC has become more apparent.

In recognition of the above, the following recommendations have been formulated in order to:

1. Continue the existing emphasis on pollutant controls.
2. Clarify the role of toxic pollutants in the river system.
3. Develop any additional toxic pollutant control programs that are necessary for restoration of the GCR/IHC.

These recommendations will be implemented through a cooperative, interagency effort which will be directed and sustained by EPA. The following recommendations have been developed pursuant to a thorough review of existing water quality and aquatic habitat problems in the GCR/IHC, to the extent practical with the existing data base.

5.1 ADMINISTRATIVE AND PLANNING RESPONSIBILITIES

Improving water quality in the Grand Calumet River will require the sustained efforts and cooperation of a least seven public and regulatory agencies. The Master Plan recognizes the importance of utilizing the scientific expertise of the various agency staff members. Successful implementation of Plan recommendations will require administrative coordination between these agencies. This will minimize the procedural delays associated with development and implementation of additional control programs and will facilitate more effective use of existing controls. Key agency roles are discussed below.

U.S. ENVIRONMENTAL PROTECTION AGENCY

The USEPA will continue with preparation of the Master Plan to final draft. The USEPA will encourage implementation of recommendations by responsible agencies, particularly Indiana, which has been delegated authority for the construction grants and NPDES permit issuance programs. Emphasis will be placed on USEPA and State enforcement of existing regulations and completion of studies in progress. The USEPA will stress full implementation of existing programs as a basis for new control programs. Field studies will be undertaken as required to support control programs. The USEPA will assume the lead role in coordinating interagency implementation of the final Master Plan and will designate a key contact individual to manage and monitor plan progress. In addition, the USEPA will work closely with the State and will cooperate with and support applied research programs and field investigations of other agencies pursuant to establishment of new control programs.

INDIANA STATE BOARD OF HEALTH

The ISBH will play a major role in implementation of the final Master Plan. Through management of the Federal regulatory authorities delegated to the State of Indiana, the ISBH plays a key role in management of the environmental resources of the Grand Calumet. The State has primary responsibility for revising water quality standards, wasteload allocations and NPDES permits. The ISBH will also closely coordinate with the USEPA in completion of pretreatment programs for the Gary, Hammond and East Chicago POTWs. The ISBH should also designate a key contact person.

U.S. ARMY CORPS OF ENGINEERS

Completion of the Environmental Impact Statement (EIS) on Indiana Harbor project maintenance dredging is an essential step toward implementation of the Final Master Plan. The COE assessment of alternatives to dredging and spoils disposal from the Harbor and Ship canal will contribute to public and Agency perceptions of the feasibility of remedial actions proposed for upriver sediment contamination. In addition, the COE is performing a special investigation to consider control alternatives for the most highly polluted areas of the IHC. As part of this effort, the COE will investigate the overall relationship between contaminated sediments and water quality in the GCR/IHC. As well as effects on near-shore Lake Michigan. The USEPA will cooperate with the COE in these efforts, with the intention of applying study results to the consideration of control alternatives for areas of contaminated sediments upstream of the COE dredging project.

U.S. GEOLOGICAL SURVEY

The USGS has a high degree of interest in establishing a flow monitoring program for the East and West Branches of the GCR, in cooperation with the ISBH and USEPA. Data will be used to refine existing water quality models and to support continued pollutant monitoring and dispersion analyses.

OTHER AGENCIES

The following agencies have been invited to review and comment on the draft and final Master Plan. These agencies may contribute to determining priorities, assessing the feasibility of proposed remedial actions, and evaluating new regulatory approaches and standards for the Grand Calumet River.

- U.S. Fish and Wildlife Service
- Indiana Department of Natural Resources
- Northwest Indiana Regional Planning Commission (NIRPC).

The NIRPC has exhibited a strong interest in assuming a continuing role in addressing water quality issues in northwest Indiana. The Master Plan has been made available to other interested agencies, in addition to those discussed above.

5.2 COMMUNITY INVOLVEMENT IN PLANNING AND IMPLEMENTATION

PUBLIC INTEREST GROUPS

The Lake Michigan Federation, the Grand Calumet Task Force, and other public interest groups have been (and will continue to be) invited to attend public information meetings and comment on researh findings, proposed technologies, and overall Master Plan recommendations and conclusions. A mailing list has been prepared for public interest groups. A public information meeting was held in October 1984 to announce completion of the Plan.

INDUSTRY ASSOCIATIONS AND CHAMBERS OF COMMERCE

Master Plan recommendations will be distributed to these groups by the USEPA. A contact person at the Agency and at the ISBH will be identified. It is anticipated that the major items of interest of these groups will be the schedule for implementation of industrial wastewater pretreatment regulations and any revisions to NPDES permits.

SANITARY DISTRICT RESIDENTS

Conclusions and recommendations regarding municipal wastewater collection and treament facilities, and especially regarding proposed CSO controls or impending enforcement actions, will be described in the Master Plan. Plan recommendations will be distributed to the Sanitary District offices of Gary, Hammond, and East Chicago. Local residents should monitor plan implementation.

5.3 WATER QUALITY STANDARDS AND INDUSTRIAL EFFLUENT GUIDELINES PROGRAMS

Need

The existing water quality standards for the GCR/IHC are overdue for revision and updating, based on the requirements of the Clean Water Act (CWA). Also, the designated uses of the GCR/IHC (which the criteria and standards are developed to protect) do not include the full range of uses possible under the CWA.

Recommendations

It is recommended that:

- The ISBH 1) adopt the "fishable/swimmable" goals of Section 101(a)(2) of the CWA, or 2) conduct a use attainability analysis, pursuant to Section 131.10 of the Act, and adopt the resulting appropriate use designation. Such an analysis be conducted pursuant to the 1983 USEPA publication: Water Body Survey and Assessment Guidance for Conducting Use Attainability Analysis. Practical limitations to the attainment of the "fishable/swimmable" goals of the CWA be identified and that an alternative, designated use be proposed, consistent with the result of the use attainability analysis.

- The ISBH adopt water quality criteria protective of the designated use. Such criteria be derived pursuant to USEPA draft guidelines published (49 FR 4551) in February 1984. Such criteria include conventional, non-conventional and toxic substances (including the Section 307(2)(1) priority pollutants). Criteria be either pollutant-specific, narrative, or a combination of the two. If narrative criteria are adopted, these be developed pursuant to Section 131.11(2) of the Act and include specifics to describe the methods proposed by the ISBH to regulate point source discharges of toxic substances.

- The ISBH propose new water quality standards for the GCR/IHC based on the above. Such analyses consider an accelerated schedule for standards upgrading for those portions of the system already exhibiting elevated water quality conditions (e.g., the Marquette Park Lagoons).

- The ISBH augment the wasteload allocations for point source discharges presently being completed to include toxic pollutants.

- The ISBH revise its antidegradation policy, pursuant to Sections 131.6(d) and 131.12 of the Act. This policy identify proposed methods for protecting the instream uses designated pursuant to Section 101(a)(2) of the Act, or a use attainability analysis, as described above.

Status

The Indiana Stream Pollution Control Board is currently evaluating the possibility of changing the GCR/IHC use designation from limited aquatic life, industrial water supply, and partial-body contact recreation to aquatic life and whole-body contact recreation, pursuant to the recommendations of the Grand Calumet Task Force. The Board is also considering changing the total ammonia standard to un-ionized ammonia, expanding the number of toxic parameters included under the regulation, and updating the fecal coliform standards. The results of the nearly completed WLA are being considered in these evaluations. The chloride, sulphate, and total dissolved solids standards are also being re-evaluated, especially as regards impacts on Lake Michigan.

A public hearing on the proposed revision process will be conducted, in northwest Indiana, in early 1985. Limited standards revisions are expected to be adopted in mid-1985. The State then intends further review of water quality standards, with emphasis on toxicants.

5.4 NPDES PROGRAM

Need

Historically, NPDES permit limits were based primarily on conventional and nonconventional contaminants as well as selected metals and other pollutants. These permits did not generally include provisions for control of toxic pollutants.

Recommendation

It is recommended that:

- In reissuing industrial NPDES permits, full analytical testing for toxic organic pollutants continue to be required for sources whose wastewater is suspected of containing these pollutants. Appropriate limits are being included in the new permits.

- The State and USEPA perform biomonitoring at the Gary, Hammond and East Chicago POTW outfalls. Biomonitoring also be performed at selected outfalls among the seven major industrial point sources (Citgo, duPont, Inland Steel, J&L Steel, U.S.S. Lead, U.S. Steel and Vulcan Materials) as part of Indiana and USEPA's joint, long-term biomonitoring program. Biomonitoring results be used as a screening test to determine the need for revisions to NPDES permit limits for control of specific toxic substances. Revisions to POTW limits be implemented through the NPDES program.

- The USEPA cooperate with the ISBH to ensure that the U.S.S. Lead Refinery comply with the NPDES permit conditions.

- The ISBH and USEPA ensure implementation of NPDES requirements for POTW pretreatment program development, pursuant to 40 CFR Part 403, for the Gary, Hammond and East Chicago Sanitary Districts.

- The Gary NPDES permit be reissued to reflect effluent limits specified in the wasteload allocation analysis. This new permit include requirements for proper operation and maintenance of existing POTW facilities, establishment of a replacement fund and correction of sludge handling and storage deficiencies.

- The Hammond NPDES permit be reissued to reflect effluent limits specified in the wasteload allocation analysis. This new permit include requirements for completion of sludge handling equipment construction.
- The East Chicago NPDES permit be reissued to reflect effluent limits specified in the wasteload allocation analysis. This new permit include requirements for construction and operation of sludge handling facilities.
- Under the NPDES program, a comprehensive CSO program be implemented; dry weather discharges from CSO outfalls be eliminated. CSO frequency be minimized through maximizing the efficiency of existing POTW facilities. Controls be established for CSO outfalls which require them.
- Toxic pollutants monitoring may be required for selected CSOs, based on water quality data and the nature of the industrial discharges contributing to the collection system upstream of the CSO.

Status

All major industrial discharger NPDES permits have been reissued, except those for duPont, Jones and Laughlin and U.S.S. Lead, which have been public noticed (for intent to reissue) and are expected to be reissued by Summer, 1985. The three POTW permits are subject to the conclusions of the nearly completed WLA, but are also expected to be reissued by Summer, 1985. Effluent monitoring and biomonitoring are scheduled for U.S.S. Lead, the Gary Sanitary District, and the East Chicago Sanitary District during 1985. Effluent monitoring is scheduled at Inland Steel, also in 1985.

5.5 PRETREATMENT PROGRAMS

Need

A wide variety of industrial facilities discharge process wastewaters to the Gary, Hammond and East Chicago POTWs. These wastewaters contain toxic pollutants which may pass through the POTW and be discharged to receiving waters. Also, these pollutants may be displaced in the POTW sludge in sufficient concentrations to restrict sludge recycling or reuse opportunities, or may result in environmental contamination as a result of sludge disposal practices.

Recommendations

It is recommended that:

- The ISBH cooperate with the USEPA to effect the early completion and implementation of municipal pretreatment programs for the Gary, Hammond and East Chicago POTWs. These programs be consistent with 40 CFR Part 403 regulations as well as State guidance.
- After pretreatment program development and implementation, POTWs monitor for toxic pollutant pass through. Sludge be analyzed for priority pollutants and other toxics, as necessary. Effluent biomonitoring tests be conducted to determine the possible presence of toxic pollutants in the final effluent. Pretreatment and effluent limits be revised, following industrial discharge monitoring and biomonitoring of the municipal effluent, to control pass through pollutants, protect treatment operations and enhance sludge disposal opportunities. Pretreatment program monitoring and control needs be implemented through the NPDES program.

Status

East Chicago has submitted revised program documents to the State and USEPA. Revised programs are expected to be submitted by Gary and Hammond in early 1985. Program approval for all three POTWs is anticipated by fall 1985, based on current progress. Municipal pretreatment programs will include time schedules for implementation of various monitoring requirements. Effluent biomonitoring is being performed by the USEPA and State.

5.6 MUNICIPAL WASTEWATER TREATMENT PROGRAM

Need

Since 1970, more than $108 million in Federal grant assistance has been provided to the Gary, Hammond and East Chicago Sanitary Districts for planning, construction and operation of wastewater treatment facilities. Although significant progress has been realized, existing facilities are inadequate to ensure consistent control of muncipal effluent, for protection of the receiving water. Poor management and operation of facilities also exists in some instances.

Recommendations

It is recommended that:

- The USEPA work with the Gary Sanitary District and the Indiana State Board of Health to ensure compliance with the existing consent decree regarding sludge handling, Ralston Street Lagoon cleanup, operator training and operation maintenance.
- The USEPA work with the Hammond Sanitary District and the ISBH to ensure complete construction of necessary sludge management facilities. Hammond provide a study which effectively evaluates cost-effective CSO control alternatives.
- The USEPA work with the East Chicago Sanitary District and the ISBH to ensure complete facilities planning, construction of short-term and long-term sludge handling facilities, and other requirements needed to achieve compliance with the NPDES permit. East Chicago determine the need for additional controls by performing the revisions to its CSO study requested by the USEPA.

Status

A construction grant has recently been awarded to Gary for plant operator training. Hammond was awarded a grant for solids handling facilities in September, 1984. East Chicago has retained an engineering firm (TenEch Environmental Engineers) to complete the facilities planning process.

The USEPA is pursuing an enforcement action in response to continuing violations of Gary's consent judgment. In Hammond, a consent judgment is under negotiation. East Chicago has been subject to several court orders previously; the USEPA anticipates negotiation of a consent judgment as the next step toward permit compliance.

5.7 CSO CONTROLS

Need

CSO outfalls discharge an estimated 11 billion gallons of raw wastewater to the GCR/IHC, on an annual basis. These CSO discharges may include significant quantities of toxic pollutants from industrial discharges contributing to the sewer system upstream of CSO overflows.

Recommendations

It is recommended that:

- The ISBH and USEPA evaluate the need for additional CSO controls on the basis of the wasteload allocation program and the current evaluation study of CSO impacts on water quality in near-shore Lake Michigan. These evaluations focus primarily on the need to control conventional and nonconventional contaminants.
- The ISBH and USEPA identify additional data needs to determine the impacts of CSO toxics loading on near-shore Lake Michigan, on the basis of the modeling study currently underway. These needs be coordinated with the future toxics WLA modeling process.
- Under the NPDES program, dry weather CSO overflows be eliminated, infiltration be reduced, inflow be retarded and existing POTW facilities be managed to achieve maximum reduction of CSO overflow events.
- Additional CSO control needs be identified through the NPDES program.
- The USEPA require the Cities of Gary, Hammond and East Chicago, as part of their pretreatment programs, to strictly enforce local sewer use ordinances to control the introduction of toxic industrial pollutants to portions of the sewer system subject to CSO discharges.

Status

The USEPA is currently developing a CSO policy position, which will guide the development of CSO permits. This policy document will clarify funding priorities for CSO projects and will assist in planning and implementation of additional CSO controls and permits. Completion of the CSO policy is anticipated in mid-1985.

5.8 NON-POINT SOURCE CONTROLS

Need

Non-point source pollutant loading to the GCR/IHC derives from a variety of potential sources, including contaminated sediments, highway runoff, rain scour, dustfall, seepage of contaminated groundwater and surface runoff from industrial properties contiguous to the river. The most significant sources are currently believed to include contaminants released from sediments, direct runoff from facilities contiguous to the river and contaminated groundwater seepage.

Recommendations

It is recommended that:

- The USEPA coordinate with the Indiana State review of ERRIS and NPL waste storage and disposal sites in the GCR/IHC basin. The USEPA explore, with the State of Indiana, alternatives for assigning priority to a coordinated investigation of the wastefill sites located within 1/5 mile of the river. The review of groundwater issues at individual sites be coordinated to enhance the utility of data collected in other efforts. Regulatory action under RCRA, "Superfund," NPDES or other applicable regulatory mechanisms be pursued where appropriate.
- The USEPA cooperate with the COE-sponsored investigation of alternatives for control of contaminated sediments in two areas in the harbor maintenance dredging zone. (This COE investigation has begun and is centering on two areas of the river exhibiting high levels of sediment PCBs. This study is including an investigation of the overall interaction of sediment contaminants and water quality in the GCR/IHC system. These investigations are being performed by the COE's Waterways Experiment Station.)
- Following additional data aquisition, based in part on the COE efforts referenced above, USEPA investigate alternatives for remedial action for contaminated sediments in the GCR/IHC system, upstream of the navigation channel.
- The USEPA cooperate with Indiana and the USGS to establish a flow monitoring program on the GCR/IHC. This program include consideration of groundwater contributions and be coordinated with the priority investigation of wastefill sites. The resulting flow data be utilized in pollutant disperson monitoring and modeling activities.

Status

Several of the ERRIS sites are currently under investigation by the State, but a coordinated investigation of ERRIS listed sites in the GCR/IHC basin has not yet been initiated. Investigations should be completed in 1986. The COE study of alternatives for control of contaminated sediments in the IHC has been initiated. Stage 1 of this study will be completed in 1985. Data generated in the COE investigations will contribute to the investigation of alternatives for control of contaminated sediments in upstream areas, which will be performed in 1986. The USEPA is considering a program for the Advance Identification of Disposal Sites, as a follow-on to the nearly completed COE draft EIS for disposal of dredged harbor sediments, to be conducted in late 1985. The cooperative USGS/Indiana/USEPA flow monitoring program study has been initiated.

5.9 MONITORING AND SURVEILLANCE

Need

Existing control programs and strategies are oriented toward those pollutant sources which are best understood and for which at least preliminary data exist. As the existing and new proposed control programs are implemented, the relative magnitudes and importance of various pollutant sources will change. Long-term monitoring is necessary to evaluate the effectiveness of control programs and to discover any remaining, uncontrolled contaminants sources of significance.

Recommendations

It is recommended that:

- The State and USEPA conduct fish flesh contaminant monitoring for toxics, as an indicator of bioaccumulation. Also, toxics monitoring be conducted at representative locations in the GCR/IHC.
- The USEPA cooperate with the ISBH, USGS, and COE to develop a coordinated monitoring effort for groundwater, surface water and sediment quality, as regards known contaminant sources and concentrating on toxic pollutants and resolving uncertainties in flows and loads.
- The USEPA and ISBH develop a long-term monitoring plan for specific target pollutants, to be implemented by individual agencies under existing monitoring programs. Data from all sources be provided to the State for collating. This data will be instrumental for development of a toxics WLA system and other future modelling efforts.

Status

The State and USEPA have initiated a fish flesh contaminant monitoring program and have collected preliminary samples for analysis. An initial study, conducted by the State and USGS to resolve uncertainties in flows and loads, was conducted in October, 1984. A coordinated USEPA/COE/USGS/ISBH multimedia monitoring program has not yet been developed. An interagency task force is being formed, comprised of Federal and State agencies, to develop a long-term program for monitoring of target pollutants.

5.10 WASTELOAD ALLOCATION

Need

Many of the preceding recommendations have been directly or indirectly related to the ongoing WLA modelling effort. This model, when complete, will provide a basis for regulating the discharge of primarily conventional and nonconventional contaminants to the GCR/IHC. However, as the role of toxic pollutants in the GCR/IHC becomes more clearly understood, a similar allocation mechanism will be necessary for the effective control of toxics.

Recommendations

It is recommended that:

- The USEPA coordinate with the State to implement such additional studies as are needed to empirically define the relationship between point and non-point sources of toxics and the resulting impacts on water quality, sediments and aquatic biota. Such studies include impacts on Lake Michigan and biological risk assessment evaluations.
- The USEPA support the development of a toxics WLA model as a basis for establishing discharge limits in future NPDES permits This model include point and non-point sources of pollutants; consider impacts on water quality, sediments, aquatic biota and downstream water bodies; be developed as an extension of the current WLA; and be based on updated hydrologic and pollutant source data developed as results of the preceding recommendations.

Status

A WLA study, including the contaminants regulated by existing water quality standards, is nearing completion. A modeling study of CSO impacts on water quality in near-shore Lake Michigan is also nearing completion. When complete, the results of both investigations will be utilized in determining the additional data needs to support development of a toxics WLA.

5.11 INSTITUTIONAL

Need

Comments from residents of Northwest Indiana have indicated a strong interest in the establishment of a regional or field office of the ISBH in the area. A need for such an office is perceived in order to provide for more effective communication between area residents and the State, as well as to enable more timely and effective response to environmental problems.

Recommendations

It is recommended that:

- The ISBH, through an arrangement with local agencies or other means, provide for an expanded local presence to act as a focus for more effective communication with the citizens of northwest Indiana, for all environmental media.

Status

The State Environmental Policy Commission has recommended the establishment of a regional office in northwest Indiana to better respond to local concerns. This recommendation is under review by the Governor. The State is considering an arrangement whereby the NIRPC would function as a local laison office for the State Board of Health.

5.12 TIME FRAME AND IMPLEMENTATION

Figure 5-1 presents time bands in which activities recommended in the Master Plan and other ongoing activities are targeted. It is important to note that events may occur which result in delay or acceleration of the recommended activities. For example, a newly discovered problem pollutant or problem pollutant source could require immediate investigation, shifting resources and time frames for other activities.

Implementation of the Master Plan will be closely monitored and the subject of periodic meetings and reports by the agencies involved. Details of planned activities will be presented in the annual program plans by the State. Members of the public may participate by comment on the State's program plan, by comment at public hearings, and by response to public notices on such matters as proposed permit revisions and water quality standards.

Comments on the report or on the issues raised may be made at any time to the following address:

Director, Water Division
U.S. Environmental Protection Agency
230 South Dearborn Street
Chicago, IL 60604

Figure 5-1. Projected Time Frame for Implementation of the Grand Calumet Master Plan

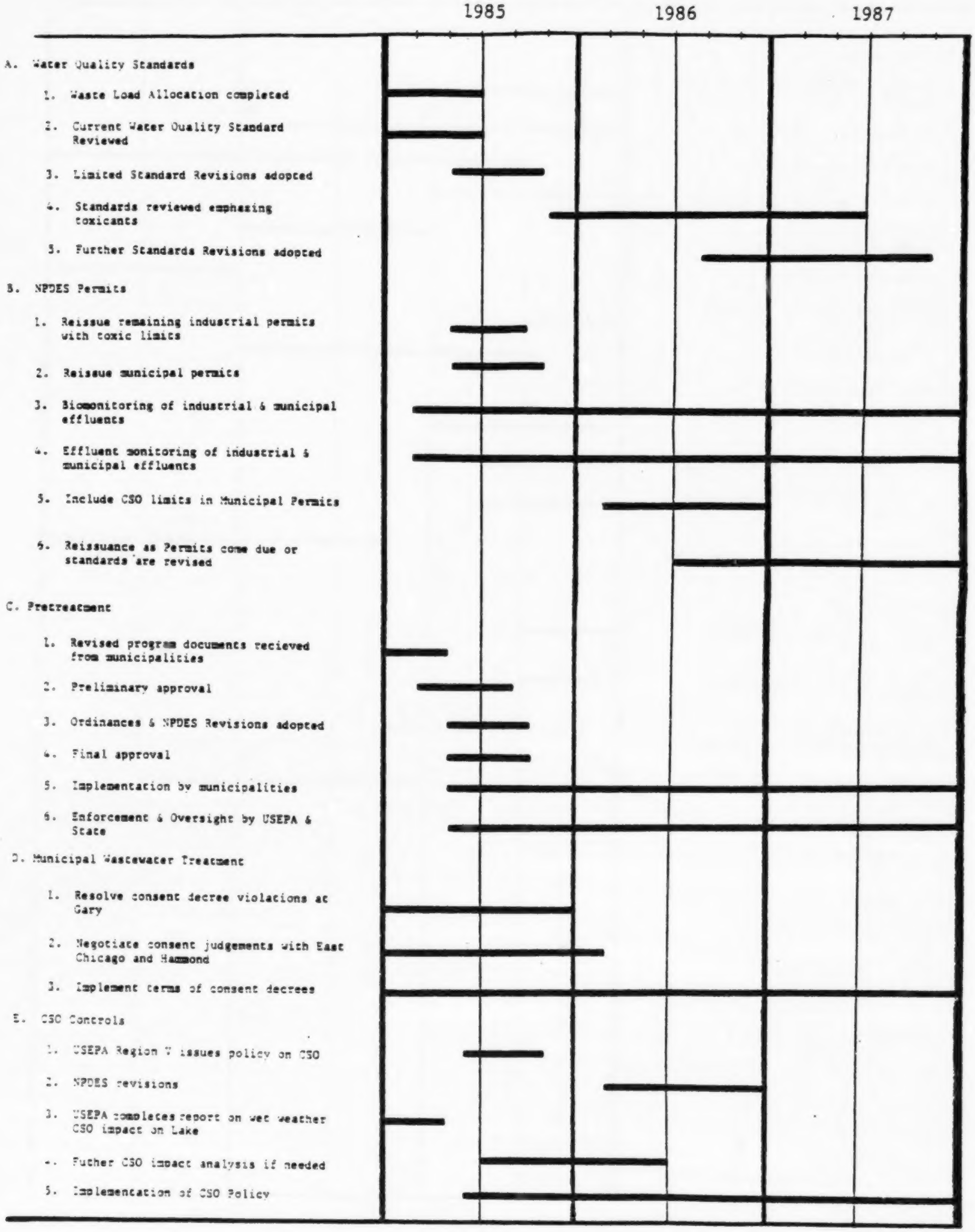
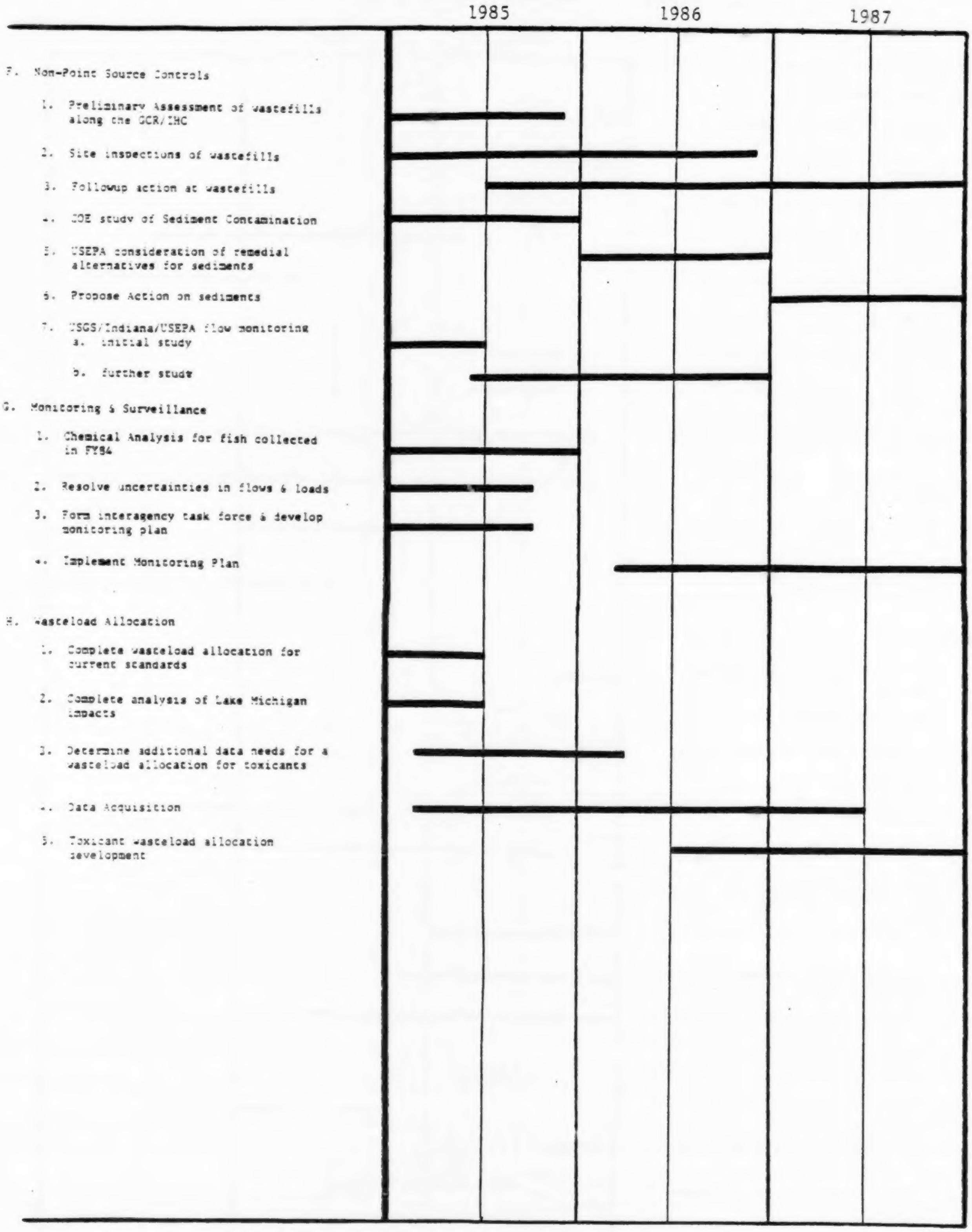


Figure 5-1. (Continued)



APPENDIX A

REFERENCES

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COE. 1981. Chemistry of bottom sediments from the Cal-Saq Channel and the Des Plaines and Illinois Rivers between Joliet and Havana, Illinois. Prepared for the U.S. Army Corps of Engineers, Rock Island, Illinois by Argonne National Laboratory Applied and Engineering Group, Argonne, Illinois.

COE. 1984. Biological and chemical water quality survey in Indiana Harbor, the Indiana Harbor Canal, and Southwestern Lake Michigan for the U.S. Army Corps of Engineers Chicago District. Research and Development Department. Prepared by the Metropolitan Sanitary District of Greater Chicago.

Combinatorics. 1974. Load allocation study of the Grand Calumet River and Indiana Harbor Ship Canal, January 1974. For the State of Indiana Stream Pollution Control Board, Indianapolis, Indiana.

CMSD. 1980. Benthic macroinvertebrates as pollution indicators in the Indiana Harbor Canal. Report No. 80-17.

CMSD. 1983. Progress of the United States Steel Corporation and other steel mills in the Metropolitan Chicago area toward water pollution control and water and sediment quality, conditions, and trends in Southwestern Lake Michigan and river systems in the Calumet area. Report No. 83-13.

Hague, R. (ed). 1980. Dynamics, exposure, and hazard assessment of toxic chemicals. Ann Arbor Science, Ann Arbor, Michigan, pg. 496.

HNTB. 1982. East Chicago combined sewer overflow water quality impact analysis Volume I: Technical Report. Prepared for Besozzi, Carpenter, and Ignelzi, Inc.

ISBH. 1984. Grand Calumet River Wasteload Allocation Study. Draft Report Prepared for the Indiana State Board of Health by Hydroqual Inc., Mahwah, New Jersey.

JRB Associates. 1984. Initial evaluation of alternatives for development of sediment related criteria for toxic contaminants in marine waters (Puget Sound). Phase II: Development and testing of the sediment-water equilibrium partitioning approach. Prepared for U.S. Environmental Protection Agency, Washington, D.C. under EPA Contract No. 68-01-6388.

Lake Michigan Federation. 1984. The Grand Calumet: Exploring the river's potential.

Lucas, Allen M. and Steinfeld, James D., 1972. Toxicity Studies of Grand Calumet River Sediments, September 1972. Cincinnati, Ohio: U.S. Environmetnal Protection Agency, Office of Enforcement and General Counsel, National Field Investigations Center, Water Sciences Branch.

PRC Consoer Townsend. 1982. Combines sewer overflow study Grand Calumet River, Little Calumet River for the Sanitary District of Hammond, Indiana. Prepared for the Board of Sanitary Commissioners, an element of the 201 facilities plan.

State of Indiana, Stream Pollution Control Board. 1978. Water quality standards for Lake Michigan and contiguous harbor areas. Regulation 330 IAC 2-2. Grand Calumet River and Indiana Harbor Ship Canal.

Technical Committee on Water Quality. 1970. Water quality in the Calumet area. Conference on Pollution of Lower Lake Michigan Calumet River, Grand Calumet River, Little Calumet River, and Wolf Lake Illinois and Indiana. Technical committee on water quality. September 1970.

TenEch. 1982. Water quality modeling of combined sewer overflow alternatives for the Grand Calumet River-Indiana Harbor Ship Canal Basin, Indiana. Prepared for the Northwestern Indiana Regional Planning Commission.

USEPA. 1980. Ambient water quality criteria documents, Office of Water Regulations and Standards, Washington, D.C.

USEPA. 1982. Environmental regulatory review: Grand Calumet River and Indiana Harbor Canal. Chicago, Illinois: U.S. Environmental Protection Agency, Great Lakes National Program Office.

USEPA. 1983a. Environmental Management Report. Attachment B. Chicago, Illinois. U.S. Environmental Protection Agency, Region 5. Valdas V. Adankus, Regional Administrator.

USEPA. 1983b. Technical Support Manual: Waterbody surveys and assessments for conducting use attainability analyses. Office of Water Regulations and Standards, Washington, D.C.

USEPA. 1984. Revised Section B of ambient water quality criteria documents. Office of Water Regulations and Standards, Washington, D.C.